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NOTES FOR THE MONTH.

In reply to a question in the House of Commons by Lieut.-Col. Arthur Murray as to when the Report of the Agricultural

**Committee on
Agricultural
Prices and
Distribution.**

Prices Committee would be published, the Minister of Agriculture, Sir Robert Sanders, replied:—"I am advised that with the exception of one or two witnesses who may be reheard on specific points, the Committee has concluded the hearing of evidence with regard to milk and dairy produce, and as soon as the mass of essential statistical data has been assembled, co-ordinated and considered, an interim report in respect of this commodity will be issued. I hope, in due course, to receive interim reports as regards fruit, vegetables and meat, in respect of which, I gather, provisional evidence has already been heard, and, subsequently, as regards cereals and bread. The hon. and gallant Member will realise that the Committee is confronted with a task of exceptional complexity and magnitude, and one which in the nature of things cannot be hastened without seriously prejudicing the Committee's investigations.

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The Ministry of Labour Gazette for February, 1923, contains a summary of the statistics relating to agricultural

**Co-operation in
Agriculture, 1921.**

co-operation in 1921 collected under the Industrial and Provident Societies Acts. This is the first article on the subject published by the Ministry of Labour since 1915.

In 1921 there were 1,201 registered co-operative societies engaged in agricultural production and distribution in Great Britain. Of these 829 were engaged mainly in the distribution of seeds, implements, manures, etc.; 200 in the preparation and disposal of agricultural products, chiefly butter and other dairy

produce; and 172 were farming and dairying departments of non-agricultural co-operative societies.

The 1,029 agricultural societies had an aggregate membership of 162,374, a decrease of 3,010, or 1.8 per cent., on that of the preceding year. The total share, loan, and reserve capital amounted to £3,820,000, an increase of £323,000, or 9.2 per cent., on the amount in 1920. The total sales realised £16,632,000, a decrease of nearly £5,000,000 (22.5 per cent.), and the year's trading resulted in a loss of £153,000, which was, however, less than that (£210,000) incurred in the preceding year.

In 1915 the special feature of these returns was the great predominance of the Irish societies in agricultural production, nearly 81 per cent. of the sales by productive societies and departments in the United Kingdom being in that country. In agricultural distribution the societies in England and Wales predominated with over 62 per cent. of the total sales. By 1920 a considerable increase in co-operative sales had taken place in both countries, but the share of Great Britain had increased more than that of Ireland, the sales by British productive societies being 46 per cent. of the whole, and by British distributive societies 80 per cent. For the year 1921 Irish figures are not available.

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UNDER the terms of the Nauru Island Agreement Act, 1920, the phosphates produced in any one year in Nauru and Ocean Islands are allocated in the following proportions:—to the United Kingdom 42 per cent., Australia 42 per cent. and New Zealand 16 per cent. These allotments are intended primarily for home consumption for agricultural purposes in the country of allotment, and not for export.

**Nauru
Phosphate.**

At the expiration of the period of five years from the coming into force of the Agreement, i.e., in 1925, and every five years thereafter, the basis of allotment is to be readjusted in accordance with the actual requirements of each country. If in any year any of the three Governments does not require any portion of its allotment, the other Governments are entitled, so far as their requirements for home consumption extend, to have that portion allotted among themselves in the proportions of the percentage to which they are entitled as given above. Any phosphates not required by the three Governments may be sold

by the Commissioners, who have been appointed under the Agreement, at the best price obtainable.

The total quantity of phosphates shipped from Nauru and Ocean Islands during the two and a half years ended 31st December, 1922, was 886,830 tons, which was made up as follows:—

To the United Kingdom	32,800 tons
„ Australia	541,420 „
„ New Zealand	80,900 „
„ Other countries	232,210 „

It will be seen, therefore, that during the period mentioned, the United Kingdom has taken considerably less than its quota. The reasons for this may be briefly summarised as follows:—

1. Owing to the present depressed state of agriculture in this country and the serious shortage of capital among farmers, the purchase of fertilisers, even of kinds well-known to the home farmer, has been considerably below normal.

2. The makers of superphosphate had long-dated contracts for supplies of North African and American phosphates much in excess of their actual need under existing conditions.

3. Owing to the fact that Nauru phosphate could not be sold to the superphosphate makers, it was put on the market in a finely ground state, in which form it was to be expected to be effective as a slow acting phosphate fertiliser, giving results similar to those obtained from basic slag. British farmers are, however, without experience of the results to be obtained from this or other ground raw phosphates. A considerable number of experiments have been started to test the value of Nauru phosphates, but time is necessary before these become available, and the dry season of 1921 caused a further delay in reaching satisfactory conclusions. The lack of this direct evidence of the value of Nauru phosphate has added to the disinclination of farmers to purchase the new fertiliser on any considerable scale.

4. Owing to the high freight charges which prevailed throughout the period during which practically the whole of the Nauru phosphate that has so far reached this country was shipped, the distributors have been unable to place the material on the market at so attractive a price as will be possible with shipments made under the present considerably reduced freight charges.

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THE steady increase in the colonies of bees in this country coincides with a marked decline in the importation of honey, for while the imports in 1919 amounted to 173,228 cwt., they dropped in 1920 to 53,021 cwt., and again in 1921 to 24,984 cwt. The British bee keeper has probably recovered much of the ground lost through the ravages from 1907 to 1912 of Acarine disease, and through the subsequent dislocation of working conditions during the years of war. Satisfactory as these figures are, however, they show that the home producer has still some leeway to make up to meet the present demand, and to educate the public concerning the value of honey in the dietary.

Further progress will probably depend on augmenting the number of bee keepers; and with this object in view the Ministry has prepared a sectional volume of leaflets, dealing with the various aspects of bee keeping, which can be obtained at a cost of 6d. by applying to the Secretary of the Ministry at Whitehall Place, London, S.W.1. Although, by reason of climatic conditions, bee keeping on a large scale in this country has been and only can be successful to a limited extent, it is not fully realised what an eminently suitable activity it is for the smallholder and cottager or for the town-worker living in the country, to all of whom it offers a profitable "side-line" occupation at a comparatively small outlay in money and time. No more space is required than the few square feet on which the hives stand, and the attention demanded by the care of a few stocks of bees is certainly less than is often expended on far less remunerative occupations. Apart from the value of the work done by bees in gathering nectar that would otherwise be wasted, it should be remembered that they are active pollinators of fruit blossoms, and therefore of inestimable benefit to the fruit grower and the gardener.

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THE average prices of several classes of agricultural produce in England and Wales were higher during January than in December, 1922, the most noticeable increases being in fat cattle, fat sheep and cheese. On the whole prices were 68 per cent. above those ruling in the corresponding month in the years 1911-13, against 59 per cent. above in December. The increase in January, 1922, was 75 per cent., so that as com-

**The Agricultural
Index Number.**

pared with a year ago prices have only receded by 4 per cent. (7 points) on the whole. The percentage increases in each month since January, 1920, are shown in the following table :—

PERCENTAGE INCREASE COMPARED WITH THE AVERAGE OF THE CORRESPONDING MONTH IN 1911-13.

MONTH.	1920.	1921.	1922.	1923.
January	200	183	75	68
February	195	167	79	—
March	189	150	77	—
April	202	149	70	—
May	180	119	71	—
June	175	112	68	—
July	186	112	72	—
August	193	131	67	—
September	202	116	57	—
October	194	86	59	—
November	193	79	62	—
December	184	76	50	—

Wheat was a little firmer than in December, whilst the rise in oats was appreciable, this cereal selling at 48 per cent. more than in January, 1911-13. Barley declined slightly, but as the fall in January is usually proportionately greater, the index figure is higher than last month. All three cereals are cheaper than a year ago, especially barley, which only averages 20 per cent. above the pre-war price. Meadow hay fell slightly, and potatoes sold at practically the same prices as in January, 1911-13.

All kinds of live stock were relatively dearer than in December, and sheep and pigs made much higher prices than in January, 1922. Fat cattle, at 61 per cent. above 1911-13, were practically the same as a year ago, and dearer than in any month since August last. Fat sheep and fat pigs were each rather more than double the pre-war price, the index number rising appreciably in each case as compared with December. Prices of fat pigs, however, were practically unchanged on the month, the rise in the index number being due to lower prices ruling in January than in December, 1911-13. Store cattle, sheep and pigs all rose in price, but while store cattle at 86 per cent. above 1911-13 were rather cheaper than a year ago, store sheep and pigs made much more money than in January, 1922. The index number of store sheep is practically the same as that of fat sheep, but store pigs at 171 per cent. above the pre-war price are relatively much dearer than fat pigs. The very high prices of store pigs are no doubt mainly due to the demand for pigs to consume the surplus supplies of potatoes.

Milk and butter remained stationary, but cheese rose sharply and, at 85 per cent. above 1911-13, was relatively dearer than butter. Both butter and cheese sold at much higher prices than in January, 1922. The fall of egg prices was not so sharp as usual so that the index number is 23 points higher than in December.

The following table shows the average increases during recent months in the prices of the principal commodities:—

PERCENTAGE INCREASE AS COMPARED WITH THE AVERAGE PRICES RULING IN THE CORRESPONDING MONTHS OF 1911-13.

Commodity.	1922				1923.	1922.
	Sept.	Oct.	Nov.	Dec.	Jan.	Jan.
Wheat ...	23	24	32	32	33	44
Barley ...	26	29	34	17	20	51
Oats ...	31	33	38	36	43	49
Fat cattle ...	58	49	48	48	61	62
Fat sheep ...	90	90	87	81	103	60
Fat pigs ...	84	85	94	94	102	71
Dairy cows ...	63	69	74	72	74	87
Store cattle ...	33	30	29	28	36	41
Store sheep ...	109	106	93	83	105	51
Store pigs ...	125	135	148	151	171	91
Eggs... ..	96	104	98	63	86	114
Poultry ...	85	77	75	86	81	76
Milk	70	90	90	90	90	125
Butter	76	71	72	73	73	46
Cheese	41	36	55	60	85	27
Potatoes ...	1	3	8	7	—1*	113
Hay	52	45	45	47	43	35

* Decrease.

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THE agreement of the Lancashire Committee for the Northern Area of the county which was due to expire on 31st January, 1923, has now been extended to 30th April.

Conciliation Committees in Agriculture.

The agreement provides for the payment of a rate of 37s. 6d. to teamsmen and stockmen for a week of the usual working hours, with proportionate rates for other workers.

Average Wages.—There was little change in the weekly wages of ordinary agricultural labourers in England and Wales during January.

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THE NEW DEVELOPMENT FUND FOR AGRICULTURE.

UNDER the Corn Production Acts (Repeal) Act, 1921, a sum of £1,000,000 was provided for agricultural research and education, the allocation to England and Wales being £850,000 and that to Scotland £150,000. After the passing of the Act decisions had to be reached in the case of England and Wales as to the period in which the fund was to be expended. It has now been agreed that in general the fund (with the interest upon it) may be expended in the five-year period April, 1922, to March, 1927, and the allocation at present contemplated is approximately as follows:—Research and Advisory work, £465,000; Higher Agricultural Education, £84,000; County Agricultural Education, £170,000; Scholarships for the sons and daughters of agricultural workers, £117,000; Miscellaneous Schemes, £74,000. This allocation is provisional, and if on investigation the schemes in contemplation prove more or less expensive than anticipated some re-arrangement may prove necessary. Particulars of grants to be defrayed wholly or principally from the new fund, in so far as definite decisions have already been made, are given below.

National Institute for Research in Dairying.—A grant of £10,900 has been approved from the Fund in aid of the erection and adaptation of buildings, the provision of engineering plant, etc., on the Shinfield Manor Estate (near Reading) for the purposes of a dairy farm for the Institute. The total cost of the building scheme is £26,000; of this sum £13,000 is being provided by the Institute and £13,000 from Government funds.

Silver Leaf Disease Research at Cambridge University.—Research into Silver Leaf Disease of fruit trees has been carried on in a very small way for several years. The Fund has made it possible to extend this work, and a larger scheme continuing until 1927 has been approved in principle. A grant of £950 for capital expenditure (accommodation for pot plants) has been approved, together with a grant of £800 for maintenance purposes in the six months ending March, 1923. It is expected that it will prove possible to approve grants at the rate of £1,550 per annum after March.

East Malling Research Station.—A grant of £6,600 has been sanctioned towards a capital expenditure by the Station amounting to £9,400, as follows:—Working Capital, £4,000; Oast

House, £1,400; Houses for Director and Caretaker. £2,000; Propagation House and Orchard House. £2,000.

Agricultural and Horticultural Research Station, Long Ashton, Bristol.—A grant of £5,000 has now been approved from the Fund towards a capital expenditure of £6,750 by the Station on the development of land, purchased in 1920, as a fruit plantation, on making a road, and providing buildings and laboratory accommodation.

Testing of Varieties of Fruit.—A scheme extending over ten years has been drawn up in co-operation with the Royal Horticultural Society for the testing of the potential value of varieties of fruit for market purposes; the scheme is under the control of a Joint Committee of the Ministry and the Society. The tests are to be carried out, in the first place, at the gardens of the Royal Horticultural Society at Wisley, but sub-stations will be set up as the scheme progresses. Approval in principle has been given to the scheme which is estimated to cost £12,000 in ten years, and a grant of £345 has been sanctioned from the Fund for the six months' period ending March next.

Experimental and Research Station, Cheshunt.—A grant of £1,125 has been approved in aid of capital expenditure by the Station amounting to £2,250 on new glass-houses, required for breeding and physiological investigations on glass-house crops.

Fruit Soils Survey.—This investigation, in which the Universities of Bristol and Cambridge are co-operating, is being directed to ascertain the extent to which fruit culture can be correlated with soil types in the two districts of East Anglia and West Midlands. Approval of the work in principle for the two years has been signified and grants totalling £700 for the year October, 1922, to September, 1923, have been promised.

Research Scholarships and Travelling Fellowships.—An expenditure of £2,000 a year has hitherto been incurred in providing these scholarships and fellowships. To this sum a further £2,000 is proposed to be added per annum until March, 1927, to enable the number of scholarships and fellowships to be increased.

Research in Animal Diseases.—A scheme for the establishment of an Animal Pathology Research Institute at Cambridge University is under consideration, and the extension of work already in progress at other centres is proposed. A grant of

£30,000 to provide for the endowment of a professorship in Animal Pathology at Cambridge has been accepted by the University Authorities, who will proceed shortly to the election of the professor.

The Provision of Technical Advice and the Investigation of Local Problems.—There are three main developments of this work which are being financed from the Fund. In the first place the Ministry's scheme of advisers in plant pathology will be completed so that there will be an advisory entomologist and an advisory mycologist at each of thirteen provincial centres in England and Wales. These centres have been increased from eleven by the establishment of advisory centres at Cardiff University College and at Seale Hayne College. In addition to the completion of the Plant Pathology Advisory scheme, it is hoped to provide veterinary advisers at selected centres (one such adviser has already been appointed at Cardiff). The cost of the Advisory Service before the Fund was established was £21,000 per annum, and an additional grant to the Ministry of £2,600 for the purpose for the academic year October, 1922, to September, 1923, has been sanctioned. In the third place the provision of funds for extension of advisory work in agricultural costings at various centres (Cambridge, Reading, Wye and Leeds) has been approved; the cost will be approximately £3,000 to £3,500 per annum.

Education at University Departments of Agriculture and Agricultural Colleges.—£64,000 has been provisionally allocated for grants in aid of capital expenditure at University Departments of Agriculture and Agricultural Colleges. The following projects have been, or will be, aided out of this money. A grant of £15,000 enabled the Royal Agricultural College, Cirencester, to re-open at the beginning of the present session after having been closed since 1914, owing to the War. The scheme for providing new buildings for the Agricultural Department of the University of Leeds, which had to be stopped in 1914, will shortly be put in hand (grant £15,000). The University of Cambridge has been promised £10,000 to enable the School of Agriculture to acquire the freehold of the two farms, now held on a precarious leasehold tenure and used for teaching and research purposes. A grant of £1,500 to the Governors of the Horticultural College for Women at Swanley has enabled improvements to be effected in the laboratory, the dairy and the library, and a loan of £3,500 on mortgage at 5 per cent. will relieve the financial embarrassments which have for some time been a source of anxiety to the Authorities of the College.

Proposals are under consideration for aiding the provision of new buildings for the Agricultural Department of the University College of North Wales, Bangor, and for improving the accommodation at the British Dairy Institute, Reading.

County Agricultural Education.—£70,000, spread over 4 years, has been allocated for increasing the annual grants to counties, and so make possible the extension of their systems for providing instruction and advice in agricultural subjects. A capital grant has been sanctioned to enable the Pibwrlwyd Farm Institute Scheme (Carmarthenshire) to be proceeded with, and the question of reviving the other Farm Institute Schemes (in Durham, Kent, Lincolnshire (Holland) and West Sussex), which were stopped by the Cabinet veto in 1920, is under consideration.

The National Poultry Institute Scheme.—Proposals involving a net charge on the Fund of some £43,500 for development of the poultry industry, have reached an advanced stage of consideration, and more than £5,000 has already been raised by the industry towards the estimated capital expenditure of £26,000. The scheme contemplates that the industry should find one-fourth of such capital expenditure. It includes provision of facilities for higher instruction in poultry-keeping and commercial experiments at Harper Adams College, for research into problems of nutrition and breeding at Cambridge, for research into poultry diseases at the Ministry's Laboratory at Addlestone, and for breeding experiments connected with egg production and table-poultry production.

Scholarships for the Sons and Daughters of Agricultural Workers.—Section 3 of the Corn Production Acts (Repeal) Act, 1921, which established the Fund, mentioned this purpose specifically as one of those to which the money was to be applied. A scheme is now in operation under which the following scholarships may be awarded annually :—

- 10 Class I, enabling the holder to take the degree course in agriculture at certain University Departments.
- 10 Class II, enabling the holder to take a 2 years' course in agriculture at certain University Departments and Agricultural Colleges.
- 300 Term Units—Class III, enabling the holder to attend courses of not more than one year's duration in agriculture, horticulture, dairying or poultry keeping at Farm Institutes and similar Institutions.

A Central Committee, which includes representatives of University Institutions, Agricultural Colleges, County Authori-

ties for Agricultural Education Representatives, Organised Associations of Agricultural Workers, the Board of Education and the Ministry, has been set up to make the selections for Class I and Class II awards, and to advise the Ministry generally on the scheme. There are at present, 3 students holding Class I Scholarships at Cambridge and 4 at other University Departments; 10 hold Class II awards at Agricultural Colleges and 73 hold Class III awards at Farm Institutes. The total cost of the scheme is estimated at £117,000.

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A SUCCESSFUL METHOD OF DEALING WITH SURPLUS MILK.

J. G. ASTON and C. T. SPROSTON.

In common with other milk-sellers the members of the Frodsham Branch of the National Farmers' Union were annually faced with the recurring problem of how to deal with surplus milk. They realized the futility of advising their members that they must only sell their milk at a reasonably profitable price, without providing an alternative method for dealing with the milk of members who were unable to realize those prices, for in order to avoid immediate loss this small minority will sell their milk for the best price they can get at the time and thus weaken the position of the whole of the milk producers in the district.

In the early part of the year 1920 the late Mr. Robert Shepherd, of Parkside, Aston, was asked to draw up a scheme to deal with this difficulty, and a considered scheme was laid before a meeting of a large body of farmers in February of that year. The scheme was adopted and a committee was formed with Mr. C. T. Sproston as chairman. The energy with which the committee set to work may be gauged by the fact that within 4½ months of the scheme being accepted a society was formed and called the Frodsham Area Surplus Milk Society Ltd. The necessary capital—some £5,000—had been secured or promised, land had been acquired, and a splendid up-to-date factory had been built and equipped and was working.

At the opening of the factory, the Chairman, Mr. C. T. Sproston, said the object of the scheme was to manufacture surplus milk into cheese, and thereby help farmers to obtain a reasonable and fair price for their milk. Up to then during the flush season the surplus milk of the area had been dumped on

to the wholesale buyer in such quantities that he had been unable to deal with it, causing a considerable loss of the finest food that the country produces. By converting this surplus milk into good cheese the whole community would benefit.

It is easy to see that the working of this scheme ensured a level supply of milk to the wholesale buyer, and consequently the farmer can get 1d. or 2d. more per gallon for the quantity he sells. This means a considerable sum in the course of a year; for example, 2d. per gallon per day on a fifty-gallon per day dairy means 8s. 4d. per day, or £152 a year. Hence, even if a shareholder is not getting any direct profit on his capital invested in the scheme he benefits considerably indirectly.

Capital.—It was considered that it would be necessary to raise £5,000 to establish the scheme on a satisfactory basis and provide for all reasonable requirements. The money was to be subscribed by farmers, milk producers or others directly or indirectly connected with farming, on the basis of one £1 share per dairy cow, with a minimum holding of 5 and a maximum of 200 shares for each member, excepting where a reasonable case of an embarrassed financial position is established by a milk producing member. The share capital is in £1 shares bearing interest at the rate of 5 per cent. per annum. Each shareholder contributes an annual levy of 1s. per share. The interest and the levy thus balance each other, so that in practice the shareholders receive no interest on the capital, but only the returns from the operations of the factory.

System of Management.—The staff consists of one dairy maid only, with extra help when required, and the factory is managed by two Honorary Managers and a small Committee and Secretary. The system of management is not to buy or sell any milk whatsoever, but only to manufacture surplus milk into cheese and pay on results, less cost of manufacture. The financial position of the society is therefore always safe. Naturally some will be curious to know what use is found for the factory when there is no surplus milk. This difficulty was foreseen in building the premises, and the cheese room—known in the district as the Agricultural Hall—was made extra large, fitted with a wood block floor and ladies' and gentlemen's dressing rooms, and is readily let for public meetings, dances, whist drives, etc., when not required for the storage of cheese, and brings in a very handsome revenue which is applied towards the payment of establishment expenses. In consequence of these uses the dairy-maid is well occupied in keeping the premises clean.

Building and Equipment.—The building consists of a large dairy, boiler house, extra large cheese room with ante-rooms adjoining, a milk-receiving platform, where milk is unloaded and weighed before running into the vats, and a large whey tank. The equipment is capable of dealing with 7,000 gallons of milk daily. The vats are heated by steam from a large boiler. The milk is conveyed in troughs from the weighing machine to the vats, and the whey flows down a channel to the whey tank, and is readily sold to farmers in the district for pig feeding. The curd mill is controlled by electric power and the whole building is lighted by electricity. Town water is laid on and the drainage is connected to the town sewers.

The Society was registered under the Industrial and Provident Societies Acts, 1893, and rules were formulated by the Committee of Management for the control of the Society and submitted to the Government Registrar and embodied in the Government Model Rules. The Committee of Management hold monthly meetings for the purpose of transacting the business of the Society, when statements are laid before them showing the exact financial position to the date of meeting, and the number of gallons of surplus milk received and manufactured into cheese, and the cheese sold and in stock. The shareholders have an annual meeting in January and a half-yearly meeting in July, at which audited statements of accounts are produced and circulated to all shareholders.

Results.—The result of the first year's working, ending 31st December, 1921, taking into account the bad state of trade generally, and the price paid to those who sent surplus milk, was considered to be most satisfactory. The total quantity of surplus milk dealt with for that period was 90,000 gallons. For the year ended 31st December, 1922, the quantity was 12,952 gallons. Although the quantity of surplus milk dealt with during the year 1922 was much smaller than 1921, this is accounted for by the greater demand by the public for milk. The factory, however, can claim to have served the purpose for which it was originally built, and it has been a boon to many farmers when their supplies were stopped to have such a place to which they could send their milk. The Committee have been able to pay very substantial prices per gallon for the milk sent in during the past year, and the Society is in a sound financial position. The cheese made is sold only when there is a demand for it on the market.

If this article should be a means of inducing farmers in other parts of the country to consider establishing surplus milk

factories on the same lines, it would be wise for them to keep in mind the advantage of erecting the factory near a populous neighbourhood so that the premises may be let during slack periods as described above.

The Committee of Management are of the opinion that if similar factories were erected throughout the country the problem of dealing with surplus milk would be more easily overcome, and the fixing of prices at contract time would be more equitably arranged between producer and buyer. The Committee is prepared to give farmers all the assistance possible by placing their rules, etc., before them, and by receiving deputations for a personal inspection of the factory.

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SHEEP SCAB: SUCCESSFUL METHODS OF ERADICATION ON THE PRECELLY RANGE, PEMBROKESHIRE.

G. V. SLINN, M.R.C.V.S.,

Ministry of Agriculture and Fisheries.

THE Precelly Range lies in the north of Pembrokeshire and is in extent between 6 and 8 miles long and about 3 miles in breadth. The highest peak, Foel Cwm Cerwyn, is 1,760 feet above sea level. The lower portion of the range is marshy, but generally the pasturage is good and the ascent of the range is not steep. There are practically no farms or holdings on the mountain, all of them being situated along the foot. The sheep running on the range are the usual type of small cross-bred Welsh. They are allowed to run on the mountain throughout the year and the majority lamb there, only the weaker ones being brought down for this purpose. It is usual to allow one ram to about twenty ewes; lambing commences towards the end of February and terminates usually by the middle of May. The sheep are gathered for washing about the middle of June and this is done collectively. They are then turned back to the range and are brought down later in smaller lots for shearing.

The sheep on the range all belong to the farmers who have their farms at the foot of the range and have the right of grazing. No other sheep are brought on to the range for this purpose. The number of sheep on the mountain varies according to the year but the average is about 13,000.

Public Dipping Baths.—In 1910 sheep scab was very prevalent on this range and from October of that year to September, 1911, 52 cases were found. In 1911 the Board of Agriculture made an order for the double dipping of all sheep on the Precelly Mountain Range and on the farms in contact with the range. In order to carry out this double dipping effectively the County Council sanctioned the erection of six public dipping baths on the range, and during that year six centres were selected by the Chief Constable of the County in conjunction with an Inspector of the Board of Agriculture. The centres selected were at Glynseithmaen, Caermenin, Penygroes, Brynberian, New Inn, and Ffynondicki.

The baths and the receiving and dipping pens were erected at the expense of the County of Pembroke. The farmers, however, undertook to do all the haulage of the material for the work. The size of the pens varies slightly at the various baths, but the average is 36 ft. by 30 ft. At one bath, Brynberian, where a large number of sheep are dipped, there are two dipping tanks side by side with pens 52 ft. by 30 ft. The dipping tanks are made of concrete and the fencing of the pens is of half width old railway sleepers and originally, square mesh sheep netting, somewhat similar to that in use in Canada, was used. This, however, was found to be too large a mesh and an ordinary small mesh wire netting was substituted and proved effective. The cost of the six stations was £126.

At first the floors of the pens were natural earth; this, however, was found to be very undesirable as the baths were fouled very quickly, necessitating continued and otherwise unnecessary cleaning of the tank and renewal of the dip. In 1918 the County decided to cement each of the receiving pens at a cost to the County of just under £320, which amount represents the cost of cement and labour connected with mixing and laying the concrete; the farmers provided the aggregate and as before did all the haulage. It must be borne in mind in connection with this expense that the baths are widely distributed and in out of the way places, with no facilities for lodging the workmen who had to be conveyed to and from work, and the high prices ruling during the year this work was done (1918) must also be taken into account.

The plan and illustration show the arrangement at Brynberian, where two tanks are provided. Water for the baths and for cleaning the receiving pen is conducted by gravitation from

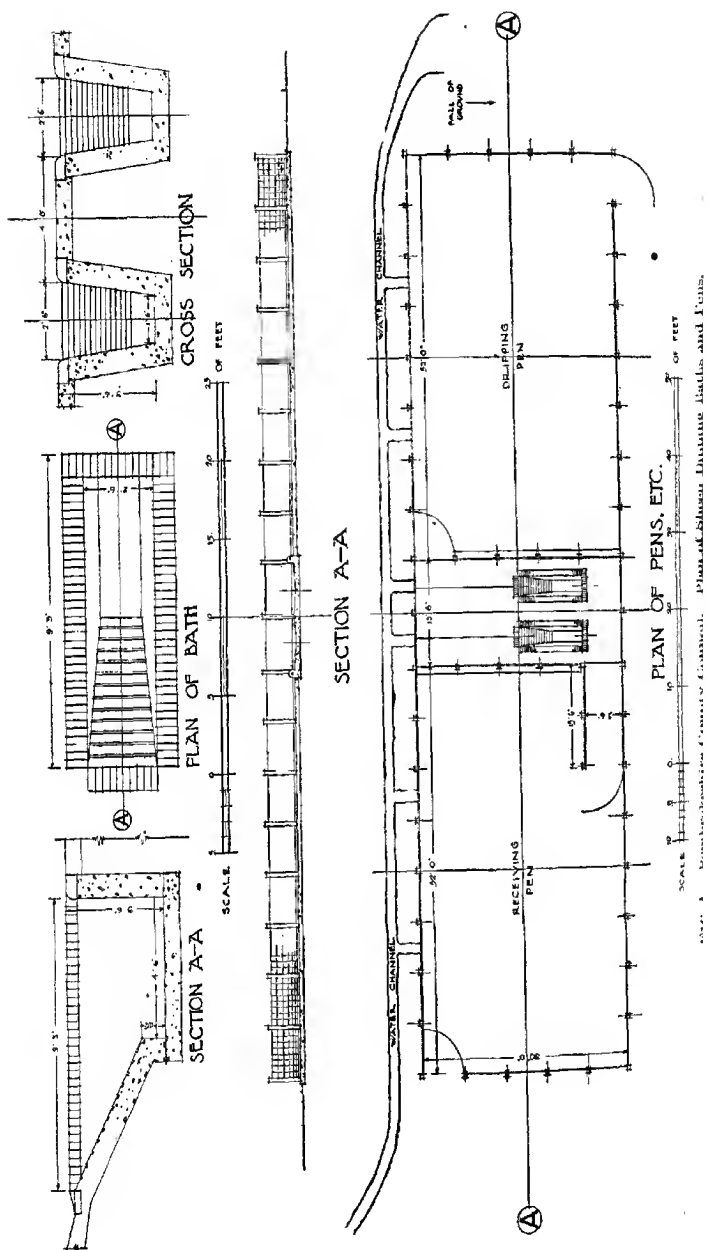




FIG. 2. General View of Sheep Dipping Baths and Pens.

watercourses in the vicinity of the baths, no outlets are provided and the baths are emptied by bailing : it was thought that with a pipe outlet there was danger of this getting stopped up with sediment. The County last year sanctioned the cementing of the dripping pens and this work will be put in hand in due course, thus making what will be as near as possible ideal dipping baths and centres.

Progress of Eradication.—In 1911 the County supplied the sheep dip and all the sheep on the range were dipped free of charge. In the following year the County again supplied the dip but a charge of one penny per sheep was made for the double dipping, and this was collected by the Police Officers in charge at each bath. From 1913 to the present day the farmers have supplied their own dip, and they also keep the fencing of all the pens in good order. The County authorities continue to be responsible for the upkeep of the baths and undertake any necessary repairs. In winter the baths and floors of the pens are well covered with bracken and similar material as a safeguard against injury from frost.

The double dipping Order was kept in force until 1914, in which year the number of cases of sheep scab on the range was reduced to three. Since 1915, in the absence of scab, a single dipping only has been carried out, and it is very satisfactory to be able to record that from 1915 to the date of writing no case of sheep scab has been found on the mountain or traced to sheep running thereon. For this excellent result the action of the County Authorities in equipping the centres, the very thorough manner in which the dipping has been organised by the Chief Constable of the County and carried out by the Police Officers under him, and the ready co-operation of the flock owners, are responsible.

Method of Dipping.—The arrangements for carrying out the dipping are as follows :—

The date is fixed for the dipping by the Local Authority and the farmers are given due notice. On the day before the dipping two Police Officers are told off for duty at each centre, where they arrive at 10 in the morning and satisfy themselves that the baths and pens are in order and clean, and the fencing in good repair. They then accompany the farmers with their dogs up the mountain. When they all are at their respective stations along the top ridge of the range the Superintendent of Police in charge gives the signal, usually by waving two flags, to start driving the mountain, the signal

being given as nearly as possible at an agreed time. The whole of the mountain is thus simultaneously driven and all sheep brought down to the various centres in order to commence dipping as early as possible on the following morning. The control of the sheep during the night is by watchers and dogs, and works satisfactorily. On the day of dipping another party with dogs, and again accompanied by the police, start in the morning as soon as it is light from each centre and search the mountain to collect any stray sheep which may have escaped the first drive, and no sheep are allowed to return to the mountain until all the parties have returned with the collected strays, after which the sheep which have been dipped are permitted to go back to the mountain.

A police officer is in charge of each bath and he supervises the mixing of the dip in strict accordance with the manufacturer's directions and sees that the dip is one approved by the Ministry. He also sees that the dip is kept up to full strength and sees that every sheep is properly and effectively dipped. The length of time each sheep is in the bath is taken by the watch.

The number placed in the bath at once varies from three to five in accordance with the size of the sheep. The officer in charge also keeps a record of the number of sheep dipped at his centre. At the single dipping in August of last year 12,849 sheep were dipped and no casualties occurred; in addition to these 1,676 sheep were brought to the baths from farms adjoining the range and in contact with them, making a total of 14,525.

From the above particulars it is, I think, clearly shown that sheep scab can be eradicated from a mountain range if the following essentials are carried out:—

(1) A simultaneous double dipping with an approved dip of all the sheep on the range, the mixing and keeping up of the strength of the dips used being under adequate supervision, and the length of time the sheep are in the bath checked by the watch and by no other method.

(2) The provision of adequate baths at selected stations.

(3) The thorough driving of the whole range by parties, each accompanied by an officer of the Local Authority, the first drive to be on the day before the day of dipping.

(4) A second drive, the parties again accompanied by an officer of the Local Authority on the day of dipping to gather all strays not collected on the first drive.

(5) No sheep to be allowed to return to the mountain before the return of all parties from the second drive.

In conclusion I would express my thanks to Mr. Summers, Chief Constable of the County of Pembroke, and to Mr. A. H. Thomas, A.R.I.B.A., County Surveyor, the former for much valued assistance and information and the latter for specially drawing plans of the bath and supplying particulars as to the cost of the work for the purpose of this article.

* * * * *

GLIMPSES OF AMERICAN HORTICULTURE.

II.

HORTICULTURAL RESEARCH STATIONS.

W. G. LONJOIT, O.B.E., J.P.,

Controller of Horticulture, Ministry of Agriculture and Fisheries.

Arlington Experimental Farm.—The Federal Experimental Farm at Arlington, near Washington, forms part of an estate which at one time belonged to a member of the family of George Washington, and it is rumoured that in the early days of settlement it was exchanged for a few barrels of tobacco. The land under cultivation has been added to by filling up extensive marshes with dredgings from the River Potomac. The débris is drawn up from the river, and then forced by compressed air through pipes to the site desired.

The apple experiments embrace some seven hundred varieties. Most of the trees were bearing good crops at the time of my visit in May, 1922. There were several examples of pear blight on the pear trees, which were bearing no crop, and none of them looked really healthy. Large collections of roses, irises, and peonies are maintained.

A distinctive feature of the operations is a large installation for cold storage, the object being to determine the extent to which cold storage of fruit can be carried out commercially, especially for grape fruit from the southern states. This fruit, which is usually marketed in the early spring, is nearly over by the time the hot weather sets in. The investigation is to determine whether by cold storage supplies could be held back for a month or six weeks. Fruit was shown to me which had been in storage for three weeks, and during that period had

increased in value by two dollars per box. Another object of experiment is nuts. Walnuts and Pecan nuts are stored after being shelled. The latter, which are grown in the middle western states, are fast becoming an important commercial product. Potatoes were being experimented with, and some were shown me which had been in store for two years. Specimens taken out and planted had germinated.

An important experiment was in progress to determine the temperature at which apples could be preserved for the longest time in good condition, without destroying their flavour. An installation of thermo-couples was in operation for determining the temperature at the heart of the apple. The temperature curve of this was very peculiar, because it showed that while the process of freezing was going on the temperature decreased inwards to the heart, while as soon as freezing was completed the temperature increased towards the heart. I tasted apples of the 1920 crop which had been in a temperature of about 36° F. for two years. They were sound, but quite flavourless. Another experiment was with cut flowers. Specimens of *Lilium Harrisii* which had been in store for eight weeks were in quite perfect condition.

Bel Plant Breeding Station.—A branch of the Arlington Experimental Farm is the Plant Breeding Station at Bel, about twenty miles from Washington. This was the station where the late Dr. Van Pect carried out his well-known work of plant breeding. Raspberries are receiving great attention, particularly black raspberries, and crosses of raspberries and blackberries. None of the varieties I saw seemed to reach the standard of our newer varieties. Strawberries also were not neglected. Specimens of most of the European varieties appeared weak and sickly, and were evidently not happy. The American experiments are made upon a native variety.

Chestnut canker, which is spreading rapidly, and doing much damage among the trees of this valuable commercial wood, is the subject of research, the object being to discover a variety immune from its attacks.

Considerable work is being done by Mr. Darrew on stocks for fruit propagation. The favourite method of propagating these stocks at Bel is not by stock beds as with us, but by root propagation.

Cornell University.—Horticulture is treated as an important subject at Cornell University. On the vegetable trial ground

experiments were being carried out in the control of the cabbage slug. The most successful preventive was a solution of 1 oz. of corrosive sublimate in 8 gal. of water, half a cupful of which was put round each plant five days after planting, and repeated every week for three weeks; a process which may be successful but can hardly be called economically possible for commercial growing.

From Cornell University valuable extension work is carried out, the suggestion for which came from our University extension work, the object being to present farmers with the knowledge acquired by research and experiment at the University. The plan followed is to form community committees in the farming centres, from which a Council of the Committees is elected, which meets annually, and maps out the work for each county. An Executive Committee for a whole State undertakes the administration. Contact is kept up with the farmer by means of County Agents, who are similar to our County Agricultural and Horticultural Organisers. There are women agents to come into touch with the homes of the farmers and spread knowledge of kitchen gardening, home preserving and domestic economy generally.

One development at Cornell is the arrangement by which every grower within the sphere of influence of the University is telephoned to direct when it is the time to begin any form of spraying.

On the extensive fruit plantations of the University several experiments were being carried out. The cultivation was conducted by means of a caterpillar tractor and disc harrow. Pear trees had been pruned to keep them dwarfed, the object being to save labour in picking. So far as could be seen the effect was to produce a bushy tree, rather ornamental, but of decreased fruitfulness.

Geneva Horticulture Station.—At Geneva, New York State, is the famous Horticulture Research and Experiment Station, with Dr. Thatcher as Director, and Dr. U. P. Hedrick as Vice-Director. It is from this Station that the important works "The Apples of New York," "The Plums of New York," etc., have come from the pen of Dr. Hedrick. The records include an elaborate card index system extending to most varieties of fruit, with hand-painted pictures and all data as to characteristics, etc. Fruit breeding is carried out extensively with apples, plums, cherries, peaches, raspberries and gooseberries. The last produce very inferior results at present.

The American gooseberry is miserably small, scarcely bigger than a blackcurrant, and the only European sort that appears to persist at all in the American climate is "Winhams' Industry," which is being used as a parent in an endeavour to get better varieties. Experiments are also being made with wild berries, such as dogwood and elderberry, to endeavour to evolve an edible variety of commercial importance.

Close to Geneva is the city of Rochester, which is the most attractive city I saw in America, and in many respects has ideal characteristics. It has a population of 150,000, and has 1,600 acres of park. Mr. Dunbar, a Scotsman, has been in charge of the City parks for 35 years. He has established an Arboretum at Highland Park, where he has valuable collections of azaleas and rhododendrons, and incidentally he remarked that, on account of quarantine rules, he was unable to replace European specimens of either of these plants when they died. Mr. Dunbar makes a speciality of lilacs, and at the time of my visit a large collection was in full blossom. Many important new varieties are the result of his work.

Near to the city of Rochester there is a large area devoted to the production of vegetable crops for market, and extensive apple orchards. In one of these, owned by a member of the State Legislature, extending to 220 acres in all, dry spraying was in operation at the time of my visit. The formula in use was lead arsenate 15 lb., copper sulphate 5 lb., lime 80 lb. The machine used was a power installation mounted on a lorry drawn by two horses. The powder was forced through flexible steel tubes about 2 in. in diameter. The owner said his men there preferred dry spraying, and he was hoping his experiment might prove a success as he would be glad to do away with wet spraying. He said that the cost of keeping the orchards clear of weeds had been materially decreased since he had adopted the method of discing, the disc harrow being drawn by a Fordson tractor.

Wisconsin University.—The University of Wisconsin at Madison is in the middle of a large dairy country, but it is developing an important horticultural station with a keen staff devoted to research in horticultural problems. Mr. Roberts is giving his attention to the alternate habit in apples. He believes it is a result of the difference in balance between hydrocarbons and nitrates. He showed me apples of the variety "Wealthy" in pots, by treatment of which he was controlling the fruiting. An interesting example of what he considered

to be a proof of the correctness of his theory was four salvias of the "Pride of Zurich" variety. They had been used in an experiment for testing the effect of long and short periods of daylight upon the growth of plants. Those that had been subjected to the long daylight were large and sturdy plants. Those which had been subjected to the shorter light were small and dwarfed. Mr. Roberts had taken these, and had applied nitrate to one of each. That one which had been in the long daylight and had nitrate applied had been thrown into vigorous and succulent growth. The other, which had been subjected to the short daylight, after the application of nitrate had produced abundant flowers. Mr. Roberts was also carrying out experiments in mosaic disease, and he had come to the conclusion that it was largely a matter of temperature. In his opinion the optimum temperature for potato mosaic disease was from 50° to 65° F., while the maximum temperature at which it could exist was 75° F. For tobacco the optimum temperature was 82° to 86° F., and the maximum temperature 97° F. Onion smut had been a subject of experiment, and it was found that treating the land with formaldehyde when drilling the seed was a preventive.

The extension work carried out by this University is on a different system from that of Cornell. Here the County Agents, who are graduates, visit the farmers, and on communication from them an expert on whatever difficulty has to be solved is sent out direct from the University to the farm.

Florida University.—Florida University is situated at Gainesville, a city where the main line of the railway runs along the centre of the main street. One important object of experiment is to discover a grass which will endure in the climate of Florida. Specimens collected from China and Australia are being cultivated. Mr. Berger is here carrying out the culture of parasitic fungi for the destruction of scale. Cultures are made in bottles by the gross, and sold to farmers at three dollars a dozen. Cultivation of citrus fruit is an important industry in Florida, and experiments are being carried out at the University to determine the amount of moisture absorbed by the trees. Huge tanks are used in which the trees are planted, and care is taken to measure them, and the water given. The surplus is drained off at the bottom of the tank and then measured.

It was the writer's good fortune to see the system of fighting the citrus canker in operation. It is well known that

this disease, of Asiatic origin, has threatened the cultivation of citrus fruits with extinction. "The spot visited was near Fort Lauderdale, at the extreme South of Florida. It was an affected grove in the "Everglades," a vast area on the confines of the Indian territory which is only sparsely settled. About forty scientifically trained inspectors from all over the State were concentrated there. They lived under real "Wild West" conditions. Each inspector is dressed in white overalls before going into the grove, and on leaving, everything exposed is washed in formalin. Each tree is thoroughly inspected, the affected ones marked, and then follows a party with a flame projector by which the marked trees are burnt to the ground. Afterwards the roots are pulled up by a tractor, heaped together, and burnt. The whole of the soil and the dykes and surroundings are burnt over, treated with formaldehyde, and the place is quarantined for two years. One fine grove of grape fruit just in full bearing was in process of complete destruction—and there is no compensation to the unlucky planter!

One feature of the State organisation of Florida is the elaborate inspection of nurseries which is carried out in connection with the plant quarantine. A copy of every invoice of nursery stock sold in the State is sent to the University and filed. No movement of nursery stock is allowed without a permit, and track is kept of all nursery stock coming into the State from any other State. This involves a most elaborate organisation, and the Quarterly Bulletin of the State Plant Board of Florida gives the number of inspectors and other officers engaged in this work as 102.

Canada.—At Ottawa there is a State Experiment Farm where extensive work is being carried out in investigations upon the degree of resistance of apples to the severe cold of the winters in Canada. Plant Breeding is being done with strawberries and roses, and many types of flowers. Great interest is taken in the question of registration of new plants, and the discussions which have taken place in the Council of Horticulture here have been watched with great interest. The Department there would be willing to co-operate with us if effective measures could be elaborated.

The Canadian horticulturist is a greater believer in legislation than are his confrères here. A Bill was then in progress before the Canadian House of Commons for the establishment of compulsory grading of potatoes and onions, and for the standardisation of packages for vegetables. This Bill has since been passed into law.

A TRIAL OF MOWING MACHINES.

It is a well-known fact that the mower is of comparatively recent development, and although a crudely designed reaper was in use in a few districts a hundred and fifty years ago, it was used only for cutting the grain crop and was unknown to the majority of farmers. In its general principle of a reciprocating knife passing through a series of slotted fingers the mechanical mower has undergone practically no change since its invention. Such improvements as have been made are of recent date, and affect the details of the independent parts and the method of traction. They cannot be said to have contributed anything in the way of evolving new or improved principles in the machine as a whole. Little, if any, serious investigation has been made in this direction, although there is every indication that work along these lines would be amply rewarded.

The possibilities of the mower have in recent years been decidedly enlarged as a result of the successful introduction of the agricultural tractor. In America, mowers have been devised for attachment to the tractor, and a number of these attachments were introduced into this country after the War. They have attracted considerable attention from the agricultural community from whom numerous inquiries have been received by the Ministry as to their utility. With a view to obtaining some general data as to the performance of these mowing attachments comparative tests have been made of an ordinary horse mower, two-horse mowers drawn by a tractor, and four tractor mowing attachments. The tests took place in July, 1922, at Abbots Hall Farm, Great Wigborough, Colchester, on land placed at the disposal of the Ministry by the courtesy of Mr. H. M. Everard, Terling, Witham, Essex.

Before proceeding to set out the results obtained at Great Wigborough it may be of use briefly to review the general advantages and disadvantages of horse-drawn mowers. First as to disadvantages: the irregularity in the speed of horses affects the quality of the mowing: horses are often pulled up abruptly when a particularly heavy patch of grass is encountered, thus involving backing and restarting and a consequent loss of time and labour: horses cannot be worked for long hours together on a heavy crop, a change usually being necessary at midday.

On the other hand the work done by the horse mower is generally good, whilst the danger of knife-breakage is reduced to a minimum owing to the abrupt stoppage of the horses when an obstacle is encountered.

It was to be anticipated that tractor-drawn mowers and tractor mowing attachments in virtue of their greater capacity and power would overcome many of the disadvantages found with horse-drawn mowers. A machine can be driven at a constant speed for long hours, cut a greater width, and is only slightly affected by irregularities in the density of the crop.

In the tests records were taken of each device under the two main heads: (a) economic, and (b) mechanical. Under (a) the following data were collected:—

- Cost of fuel, lubricants and general upkeep in relation to capacity.
- Labour, amount and cost.
- Cleanness of cutting.
- Capacity in acres per day of 8 hours.
- Working costs per acre.
- Quantity of work done.
- Damage done to crop through weight of wheels and equipment of wheels.

Under (b):—

- Weight of machine.
- Drawbar load.
- Gear losses and efficiency.
- Speed of cutting.
- Construction of cutter bar and component parts in relation to efficiency of cutting.
- Ratio of knife speed and travelling speed.
- Effect of different textures of grass on knife speed. (Time did not permit this test to be completed.)
- Effect of moisture on knife parts.

The Test Ground and Scheme of Test.—The land on which the test took place had very prominent stretches and carried a very uneven crop. In consequence the conditions imposed on the machines were severe and were calculated to reveal any weaknesses in design or construction.

The crop was composed of mixed grasses with a preponderance of ryegrass and had been laid down for pasture. It was a rather poor crop yielding from 16 to 20 cwt. per acre, as against the average of $21\frac{3}{4}$ cwt. per acre for permanent grass in England and Wales.

The machines were worked each on more than one field in order to equalise, as far as possible, the conditions of test.

Results.—

(1) *The "Albion" Horse Mower.*—Manufactured by Messrs. Harrison and McGregor and Co. Ltd., Albion Iron Works, Leigh, Lancs. Price, July, 1922, £30.

The pitman wheel on the Albion machine is driven from a pinion engaging with a toothed wheel rigidly attached to the land wheel. The connecting rod is of iron. A 5 ft. cutter-bar projects from the left and is mounted on small wheels, the height of the inner one of which is adjustable. The cutter-bar is rigid and is fitted with 3 in. centre fingers. It is attached to the main frame by a double jointed concentric hinge which retains the throw of the knife exactly the same from centre to centre at any angle of the cutter. The lifting and tilting levers are conveniently placed, and are easy to operate.*

Total working time	...	...	...	8 hr. 37 min.
Total acreage cut	...	...	...	64
Acres cut per hour	...	...	...	0.75
Cost per acre	...	...	...	3s. 4d.

Two horses were required to draw this machine and these were changed at midday for a fresh pair. The horses were worked at a good pace, but were given frequent rests. The time occupied by resting has been included in the total working time. Owing to the rigid construction of the cutter-bar, good cutting could not be done in the furrows when working on the stetched land. This machine showed the highest cost per acre cut, whilst the acreage cut per hour was the lowest. This result was due to the slow speed of travel and the small width of cut, as compared with the tractor-drawn devices.

(2) *Bentall Horse Mower.* (Experimental Machine).—Manufactured by Messrs. E. H. Bentall & Co., Malden, Essex. Price, July, 1922, £30. Fordson tractor, £120.

During the tests two types of Bentall machines were used, one of the standard and the other an experimental type. The chief difference between the two machines was that the experimental machine was lighter and the caster block was mounted with the ring cover.

A 4 ft. 6 in. cutter-bar is mounted on runner wheels, and is placed on the right hand side of the machine, well under the observation of the operator. The lifting and tilting levers are easy to operate. A foot clutch is provided for engaging the gears.

The drive is obtained by spur and bevel gearing from the main axle, and the pitman wheel actuates the knife by means of an iron connecting rod. Ample provision is made for lubrication.

Total working time	...	...	...	4 hr. 18 min.
Total acreage cut	...	...	...	4.7
Acres cut per hour	...	...	...	1.09
Cost per acre	...	...	...	3s. 2d.

This machine was drawn by a Fordson tractor, and required a mowing operator in addition to the tractor driver. The cost of this method was high and only a small acreage was cut per hour, but the quality of work done was excellent. The results obtained in the test must not be regarded as a reflection upon the design of the machine, but rather as a proof that under the conditions of test, the use of a single mower drawn by tractor is not economical.

* A detailed description of each machine is not given as the reader will be familiar with the general constructional details of the modern mower. Reference is made solely to special features.

(3) *Bentall's Horse Mowers (Two Machines).*—Hitch manufactured by Messrs. Kingdon & Co., 105, Whitecross Street, London, E.C.1. Price, June, 1921, £4 12s. 6d.

A Bentall standard and an experimental type machine were coupled together by means of a Kingdon hitch and drawn by a Fordson tractor.

Total working time	...	...	...	5hr. 17min.
Total acreage cut	...	...	...	13.1.
Acres cut per hour	...	...	...	2.48.
Cost per acre	...	...	...	1s. 11d.

Six inches were allowed for overlapping, so that altogether the width of cut was 8 ft. 6 in. The tractor proved easily capable of hauling the two mowers, but there was awkwardness in turning corners. The hitch permitted the drawbar of the second machine to drop and the fingers of the cutter-bar on the rear machine had therefore a tendency to dig. Both mowers did excellent work, but owing to the speed at which they travelled the bearings became hot and frequent lubrication was necessary.

The high speed of working and the great width of cut more than set off the cost of the extra labour required. Subject to there being a sufficiently large acreage, there is no doubt that where a farmer owns two mowers, and a tractor, good results can be obtained by employing them in this manner.

(4) *The Cutmore Mowing Attachment.*—Manufactured by the Roderick Lean Manufacturing Co., English representatives: Messrs. A. Dugdale Ltd., 65, Conduit Street, London, W.1. Price, July, 1922, £34 10s.

The Cutmore mowing attachment is constructed solely for use with a Fordson tractor. The 6 ft. cutter-bar projects on the right side, midway between the front and rear wheels. The pitman gear is actuated by an enclosed shaft, driven in its turn by a chain from the main worm shaft at the rear of the tractor. A cover effectively prevents the pitman wheel from becoming choked by grass. The cutter-bar is fitted with 3 in. centre fingers, and a clearance of about 1/16 in. is permitted between the finger and the blade. Six arched wearing clips are provided. The cutter-bar runs on two shoes and levers are provided for lifting and tilting it. The clutch lever for engaging the mowing attachment is conveniently placed. In the event of the cutter-bar encountering an obstacle, a wooden safety peg on the drag bar is broken, which causes the tractor foot clutch to be withdrawn and so prevents damage to the cutter-bar.

Total working time	...	...	...	15 hr. 3 min.
Total acreage cut	...	...	...	23.7
Acres cut per hour	...	...	...	1.58
Cost per acre	...	...	...	1s. 11d.

The knife speed of this device was comparatively slow, and in consequence it was found necessary to run the tractor fast in order to obtain efficient cutting. The cutter-bar was flexible and followed the contour of the ground very closely. On rough ground the wooden safety pin was broken very frequently, and a larger pin might be used without risk of damage to the attachment. The lifting lever was not easy to operate. The nuts required frequent attention, as the vibration of the tractor caused them to work loose.

The Cutmore cut a greater average acreage in the hour than any of the other tractor mowing attachments.

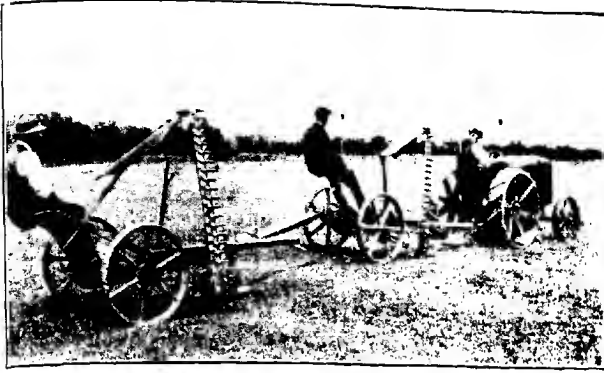


FIG. 1.—Two Bentall Mowers coupled by Kingsdon Hitch.

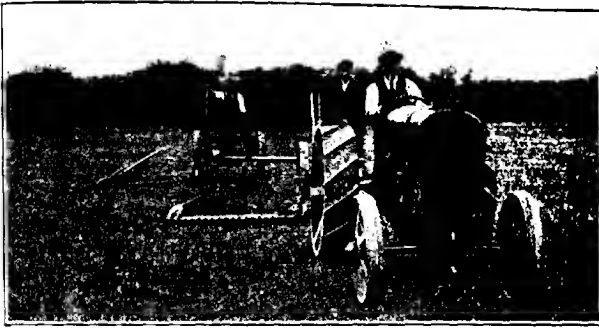


FIG. 2.—Two Bentall Mowers coupled by Kingsdon Hitch.

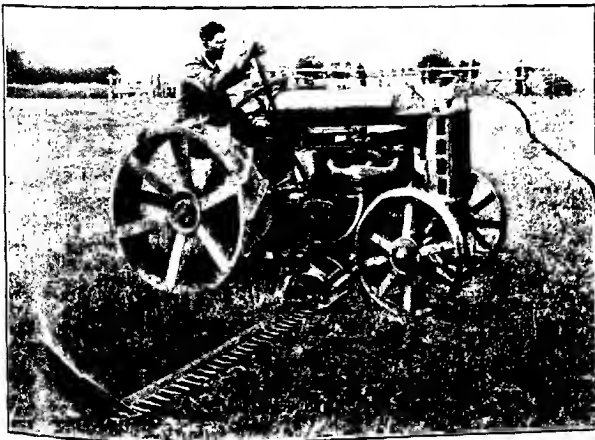


FIG. 3.—The Cutmore Tractor Mowing Attachment.

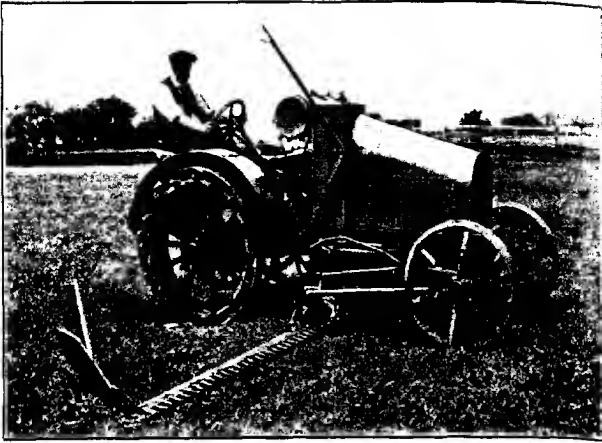


FIG. 4.—The International Tractor Mowing Attachment.

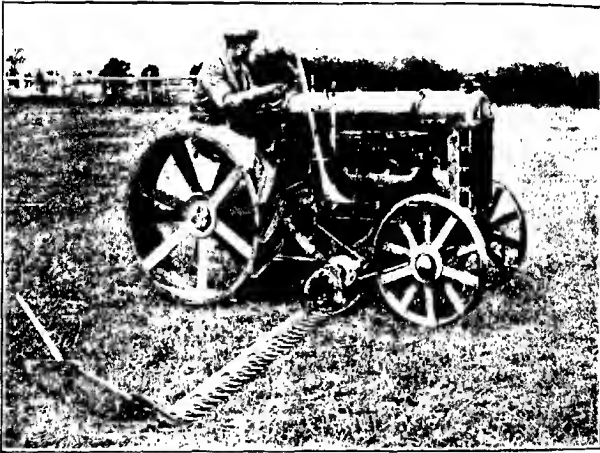


FIG. 5.—The Otwell Tractor Mowing Attachment.

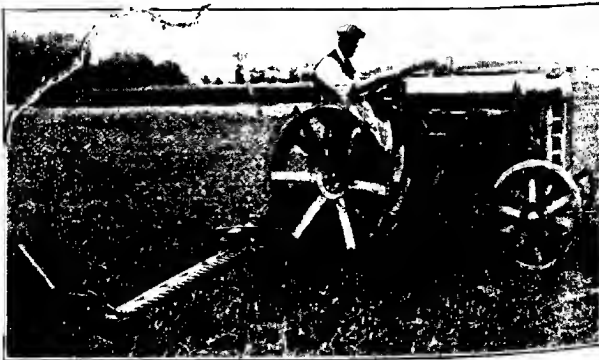


FIG. 6.—The Taco-Myers Tractor Mowing Attachment.

(5) *The "International" Tractor Mowing Attachment*.—Manufactured by the International Harvester Co. (Great Britain) Ltd., 80, Finsbury Pavement, London. Price, July, 1922, £37; Tractor, International Junior, £250.

This attachment is constructed solely for use with the International Junior Tractor and has a 7 ft. cutter-bar. The pitman wheel is placed on the left hand side of the tractor and is driven from the main transmission shaft. A wooden connecting rod operates under the tractor, while the cutter-bar is placed on the right hand side midway between the front and rear wheels. The cutter-bar runs on two shoes and is fitted with 3 in. centre fingers. Two levers are provided, one for lifting, the other for tilting the cutter-bar.

Total working time	...	...	...	6 hr. 3 min.
Total acreage cut	...	...	...	73
Acres cut per hour	...	...	...	1.21
Cost per acre	...	...	...	2s. 11d.

Very good cutting was done with this attachment on level ground, but on rough ground the fingers on the cutter-bar dug in, owing to the tilting lever not having sufficient movement. The lifting lever was awkwardly placed and difficult to operate and it was necessary for the tractor driver to leave his seat in order to reach it. In consequence it was impossible to take full advantage of the speed of this tractor.

(6) *The Ottwell Tractor Mowing Attachment*.—Manufactured by the Ottwell Mowing Company, 6538, Livernois Avenue, Detroit, U.S.A.

The Ottwell attachment is constructed solely for use with a Fordson tractor, but differs from other Fordson attachments inasmuch as the pitman wheel is driven by means of an enclosed shaft from the pulley shaft. The whole attachment is placed on the right-hand side of the tractor, and the cutter-bar projects midway between the front and rear wheels.

Total working time	...	...	...	8 hr. 35 min.
Total acreage cut	...	...	...	12.9
Acres cut per hour	...	...	...	1.51
Cost per acre	...	...	...	1s. 10d.

The cutter-bar on this attachment was not very flexible, and consequently good cutting was not done in the furrows. The pitman wheel was a great source of trouble, as owing to its position close to the ground it was frequently choked with grass and the bearings became hot. The spring suspension of this attachment was very good.

(7) *The Taco-Myers Tractor Mowing Attachment*.—Agents—The Tractor Appliance Company, 58, Middlesbrough Road, Coventry. Price, July, 1922, £45.

This attachment is constructed for use with a Fordson tractor. The pitman wheel is mounted on a shaft which forms a continuation of the working shaft of the tractor, a very simple drive being obtained by this means. The cutter-bar is placed on the right hand side, to the rear of the tractor driving wheel. The cutter-bar is very flexible and the whole method of suspension very good.

Total working time	...	...	...	11 hr. 15 min.
Total acreage cut	...	...	...	17
Acres per hour	...	...	...	1.51
Cost per acre	...	...	...	2s. 6d.

The acreage cut by this attachment was high, while the excellent suspension and flexibility of the cutter bar enabled very close cutting to be done.

Though a simple drive is obtained by placing the attachment at the rear of the machine, this advantage appears to be more than offset by the fact that the tractor driver is compelled to look back to observe the work done. The clutch for throwing the mowing gear in and out of action was found to be inaccessible to the tractor driver. The lifting lever required great exertion to operate it, and in addition was set too close to the tractor wheel. The pitman wheel frequently became choked with grass owing to its closeness to the ground and lack of protection.

Economic Results.—The principal economic factors to be taken into account in estimating the relative cost of the various machines tested are (a) Capital cost, (b) Labour required, (c) Width of cut, and (d) Speed of cutting.

The prices of the various mowing devices varied from £30 for the horse mower to £45 for the Taco-Myers tractor attachment. The mowing machine (as distinct from the tractor attachment) required one man when drawn by horses, two men when drawn by tractor, and three when the double unit was drawn by a tractor. On the other hand, only one man was required throughout with the tractor mowing attachments. The width of cut and the speed of cutting enabled every tractor attachment to do nearly double the work of the horse drawn mower.

While there was found to be no substantial (if any) advantage in operating a single mower with a tractor rather than with horses, it was clearly substantially cheaper to operate two mowers by tractor, or to use a tractor attachment. Between these two methods of employing a tractor there is probably little difference in cost in the long run, but the saving in capital cost when only an attachment has to be purchased is nevertheless an advantage, and there is the further consideration that every reduction in the items of machinery on the farm, so long as there is no loss in efficiency, tends to a reduction in overhead expenses.

It will be recognised when examining the figures of cost per acre contained in the table that while they give a general indication of the relative cost of each method they do not give a precise indication of the relative economy of the various devices. A margin must be allowed for experimental error, and a difference of a few pence is not significant. Moreover, the particular conditions under which the test took place have to be allowed for. Owing to the width of cut the tractor wheels ran on the previously cut swath. Actually in the test no difficulty from this cause was experienced in the subsequent operations, but it is considered that if the land was soft the strakes on the tractor wheels would force the grass into the ground and hinder subsequent operations.

(To be concluded.)

CREDIT FOR AGRICULTURISTS.

THE Report of the Committee appointed by the Government to inquire into the question of Agricultural Credit has now been issued. The Committee consisted of Sir Theodore G. Chambers, K.B.E., Vice-Chairman of the National Savings Committee (Chairman), Sir Francis Floud, Secretary, Ministry of Agriculture and Fisheries, Mr. H. M. Conacher, Deputy Commissioner, Board of Agriculture for Scotland, and Mr. A. W. Hurst, of the Treasury.

It is pointed out in the Report that the cultivation of the ground, including the harvesting of crops and the rearing and management of live-stock, is not only the oldest, but the most widely dispersed occupation of civilised man. The interval between seed time and harvest, between the rearing and killing of beasts, probably necessitated in the earliest times the use of some system of credit. Indeed, it may be assumed that agriculture gave birth to the conception of credit. It is therefore natural that credit should have come to be regarded by the farmer as an essential element in the productive process. Although there has been a tendency in most countries to isolate "agricultural credit" and to treat it as a peculiar credit problem demanding special consideration, fundamentally credit plays the same part in agriculture as in any other industry. Credit has been aptly defined as the means whereby the transfer of wealth from one person to another is effected for a period of time, at the end of which it is restored to its owner. Credit cannot directly increase the actual means of production which are potentially at the service of mankind, but credit machinery can and does transfer from one individual to another, the right to use these means, and it is therefore both natural and relatively accurate from the individual point of view to regard credit as an important agent in the productive process. Nevertheless, credit is merely another name for someone else's money.

Classes of Credit needed.—The credit requirements of agriculturists are divided into:—

Long-term credit.—(a) For landowners, to be used in productive capital works. (b) For tenant farmers purchasing their farms.

Short-term credit for farmers to meet current outgoings and to facilitate the production and marketing of their products.

Long-Term Loans for Capital Works.—This form of credit is already available under State control, through the Lands Improvement Company, which was formed in 1853 for making loans to landowners for such improvements as drainage, reclamation, the erection and extension of farm buildings and cottages, silos, etc., and the provision of water supply. Applications for loans from the Company must be approved by the Ministry of Agriculture or the Board of Agriculture for Scotland. The loan is secured by a mortgage upon the property improved and is repayable by annual instalments over a period of 15-40 years according to the nature of the improvement, with interest at $4\frac{1}{2}$ per cent. net, after deduction of income tax, which represents at present a gross rate of about 6 per cent. In view of the first-class nature of the security, credit flows easily into the business and the resources of the Company are therefore practically unlimited. The Company advanced some £13,000,000 during 70 years but during the War its business was practically suspended, partly owing to the rate of interest chargeable on loans being limited by law to 5 per cent. In 1920, however, the Company obtained an amending Act replacing this maximum by such rate as the Ministry of Agriculture may approve, and its business has revived, small owners, moreover, now making more use of the Company than formerly. The similar Scottish Company, and any others which may be started are still restricted to 5 per cent.

The Committee considers that no method on an economic basis for the provision of capital for permanent improvements would be more advantageous than that described above, and recommends that the Improvement of Land Acts should be amended to empower any association operating under those statutes to charge such rate of interest as the Ministry of Agriculture or the Board of Agriculture for Scotland may approve. It also recommends that the Lands Improvement Company should be urged to consider the means of bringing the scope and advantages of its operations more prominently before the notice of the owners of agricultural estates in Great Britain than is the case at the present time.

Long-Term Loans for Land Purchase.—There is a further class of long-term credit demand which has been accentuated by the peculiar circumstances of those tenant farmers who, having purchased their holdings during recent years, now find themselves in consequence short of working capital.

In 1922 the number of holdings owned by their occupiers was 13,500 more than in 1914, the increase in acreage being

1,700,000 acres. The majority of these purchases took place between June, 1919, and June, 1921. High prices were often paid, and there is, in the Committee's opinion, little doubt that in certain individual cases purchasers were directly influenced by the Corn Production and Agriculture Acts, if not actually to embark on ownership, at any rate to pay a higher price for their farms than in other circumstances they would have been prepared to offer.

The owner-occupier is in the same position as the landowner in that he has, in his land, an absolutely first-class security to offer. The difficulty, however, in his case is that no adequate machinery has been established in this country for the purpose of granting long-term loans on real estate of which tenant farmers who have bought or wish to buy their holdings can avail themselves, and, consequently, a large number of the new owner-occupiers in the country have pledged their title-deeds as security for temporary loans of uncertain duration which they raised in order to complete their purchases.

The Committee recommend that those farmers who purchased their holdings between the date of the passing of the Corn Production Act, 1917, and the Corn Production Acts (Repeal) Act, 1921, should be enabled to obtain loans by an approved Society operating under the ægis of the State, such loans not to exceed 75 per cent. of the present value of the holding concerned and to be repayable within a period of 40 years on an annuity basis. Funds for this purpose to be advanced in the first instance by the Public Works Loans Board and, subsequently, by the issue of guaranteed stock.

Short-Term Credit.—This represents the main problem of agricultural credit. Credit for a comparatively short period is often of assistance to farmers for the purchase of seeds, fertilisers, feeding-stuffs, seasonal stock and equipment, and for the purpose of enabling them to arrange the systematic marketing of their produce. In the nature of things, loans are also needed by farmers in the course of their operations for purposes which are not strictly seasonal, in the sense that the period necessary to secure for the farmer a turnover on the outlay involved may extend from one to five years. The main purposes for which accommodation of this nature is required are for the initial purchase by breeders and dairy farmers of foundation stock, the purchase of machinery and implements, and the execution by tenant farmers of minor improvements such as additional fencing or drainage, or the erection of silos and Dutch barns.

Improvements of this nature have frequently to be undertaken by tenants owing, in many cases, to the reluctance of landowners to impose further charges on their estates.

The Report deals at length with the existing facilities for short-term credit, *e.g.*, (i) banks, by means of loans or overdrafts on accounts, and (ii) auctioneers, seedsmen, manure-merchants, traders, dealers and private money-lenders, and points out that there are certain gaps in the facilities available, *viz.* : (a) credit for agriculturists who for various reasons have not effective access to present day banking facilities; (b) credit for the purchase of live stock, etc.; (c) intermediate-term credit required for a few years to enable a tenant to improve the equipment of his farm, by, for example, the purchase of permanent breeding stock, provision of equipment, machinery, fencing, drainage, etc.

To meet the need for short-term and intermediate-term credit the Committee make the following recommendation:—

“ We recommend that the State should encourage the immediate formation of Agricultural Co-operative Credit Societies, and should place a capital sum at the disposal of each Society on the basis of £1 for every £1 of share capital raised by the Society, of which not less than 5s. in the £ shall be paid up. These Societies to be affiliated through the Ministry of Agriculture or the Board of Agriculture for Scotland, to be allowed to receive deposits and to be given a free discretion as to the granting of loans to members for agricultural purposes. We further suggest that the State funds employed for the purpose of the scheme should be derived by the application of a portion of the money derived from the sale of Savings Certificates in rural areas.”

The Report (Cmd. 1810) in full can be obtained from H.M. Stationery Office, Imperial House, Kingsway, London, W.C.2. Price 9d.

FARM BUILDINGS FOR SMALL HOLDINGS.

MAJOR H. P. G. MAULE, D.S.O., M.C., F.R.I.B.A., and
A. EWART ASTON,

Ministry of Agriculture and Fisheries.

In the *Journal* for May and June, 1922, articles were published on farm buildings for small holdings dealing mainly with the single roof types erected by the North and West Riding County Councils and a somewhat similar type erected in Durham.

The present article continues this series and deals with a very interesting single roof building designed and carried out by Mr. A. P. Ker for the Northumberland County Council. From the direct and simple nature of the plan and construction, this building lends itself admirably to standardisation, and is so planned that it is particularly adaptable for the varying needs of small holders. For this reason an alternative scheme is illustrated, giving the general lines upon which such standardisation and adaptation might take place were the building required for a dairy holding.

Those who have followed the articles on farm buildings referred to will readily see that Mr. Ker's design is very similar in principle to the general lines advocated in the *Journal* for the construction of cowsheds and covered yards, and the authors have therefore ventured to link up the various points of similarity in order to produce a scheme which it is hoped combines the best and most practical features of each method.

The Northumberland Plan.—The Northumberland plan was originally designed for 50-acre holdings on the Hexhamshire Estate of the County Council and included the following accommodation:—standings for 10 cows, a hemel or covered-in yard for 10 beasts, stabling for 2 horses, a loose box, mixing floor and cart-shed with loft over, the whole being included under one single span roof carried on built-up small-~~member~~ trusses identical in principle with those used at the Ministry's Arable Dairy Farm at Hucknall.* The roofs were covered with slates, probably the most suitable and convenient roofing material in the district, though in other situations some form of asbestos sheeting would almost certainly give the cheapest and most practical results. The plan is so arranged that it

* See this *Journal*, July, 1922, "The Planning and Construction of Cow-

can be adapted to suit almost any aspect by interchanging the internal compartments without interfering with the general structure of the building.

It will be seen from the illustrations that every part of the building can be reached internally for feeding purposes by means of the central feeding passage from the barn or general food store, which is placed at one end of the long axis, thus giving access to stable, loose box, cow-standings and hemel. The openings into the hemel can be closed up during the winter months by the use of loose boarding, and this space can equally easily be turned into extra standings for cows, if required, and at small cost.

In actual practice, Mr. Ker has found that these openings make the buildings too cold in winter, and doors have since been provided. Another improvement suggested by Mr. Ker is to make the loose box larger, namely, about 18 ft. 6 in. instead of the 15 ft. shown on the plan, and by placing the doors, both external and internal, in the centre, space is made for the provision of two small boxes on each side of the 2 ft. 6 in. central gangway between the doors. These boxes could then be used for calves or pigs, making four boxes in all, each about 8 ft. by 7 ft. 6 in., the tenants providing the box division walls. This appears to be a very practical improvement to the original plan.

A further advantage of this type of building (also advocated by us in the article on cowsheds) is that if the site is sloping, the different compartments can be arranged to meet this contingency by stepping the floor levels, either in cross-sections or longitudinally, in which latter case the central feeding passage would follow the general level of the ground. Extra cost could be avoided by starting the buildings at the higher point of the site with the eaves at about 6 ft. from the ground level, sufficient head-room to back in carts and allowing ample head-room lower down the site for the various side entrances to stable, loose box and hemel.

Provision is made for loft space over the cart-shed and barn, and this space could be extended, if desired, though possibly at a higher level, over the stable and loose box.

These Hexhamshire buildings were constructed of timber grown on the Estate, oak being used for the walls and wall studding, doors and frames, and larch and Scotch fir for the roof timbers. The building is lighted by means of glass slates provided in the roof at intervals and at the eaves, where a

transom light and shuttered opening is provided to each alternate bay. A concrete base, in which the main oak supports are inserted, is provided to a height of about 18 in. above ground level, thus preserving the timber walls from damp and premature decay.

Particulars of Cost.—Five sets of these buildings have been erected under a contract at £872 7s. 0d. per set, the contract including the provision of the necessary roads, fences, installation of water from adjacent mains, and sewage disposal, which last includes a liquid manure tank with a capacity of 500 gal.

The Council had all the timber for these buildings cut to the scantlings required out of timber grown on the Estate, and it was supplied to the contractors at the Estate yard at the following rates per cubic foot:—oak, 3s. 9d.; larch, 3s.; and Scotch fir, 2s. 6d. The sites of the several blocks of buildings ranged from one-quarter to one and a half miles from the yard. The Hexhamshire Estate lies some 7 miles from a railway station, remote from any village and little local labour or accommodation was available, and it is estimated that under more favourable circumstances the cost would have been reduced to £800. Sand and gravel were provided to the contractors free of cost at a gravel pit on the Estate.

The plan (Fig. 1) and the photographs (Figs. 2 and 3) give a very good idea of this extremely serviceable building, and the Northumberland County Council are to be congratulated on their enterprise in departing from the normal quadrangular plan.

Suggested Modifications.—In Fig. 4 a plan and section is given showing the suggested standardisation and certain modifications of Mr. Ker's plan adapted for the purpose of a dairy holding.

This plan shows that each bay or unit of the building is now spaced at 10 ft. 6 in. centres in order to synchronise the spacing of the animals with the spacing of roof trusses as was shown in the former articles on cowsheds. There are certain obvious advantages in this arrangement. The construction and the provision of standings are simplified, the supports now go directly under the trusses and between each group of three cows, extension is particularly simple and an addition of one or more bays gives a corresponding increase for an exact number of animals. The feeding passage has been increased to 5 ft. as being more convenient for serving the double row

of cows now shown in place of one set of single standings and the hemel.

Another variation is the provision of direct access from the cowshed to the loose box and stable, which have been arranged so that both are readily convertible either to cow standings for four cows in each or for two smaller boxes on each side for calves or pigs. The doors have been arranged on plan to give a through access from side to side of the building either to boxes, cow standings or stable as the case may be. Thus in

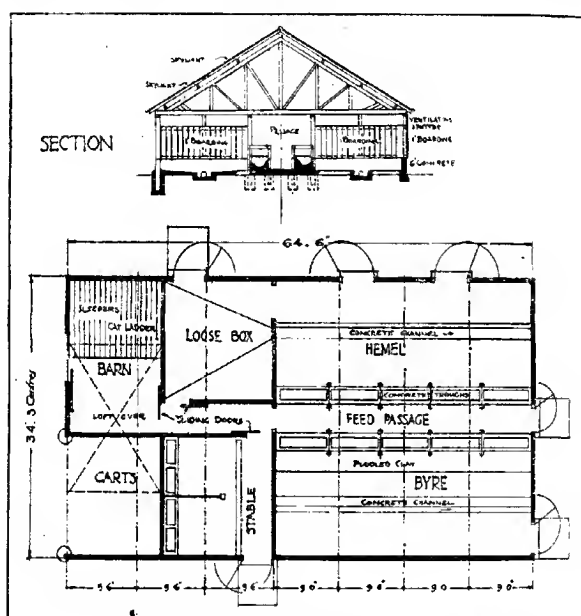


FIG. 1.—Plan and Section of Farm Building at Hexhamshire, Northumberland.

the event of an open yard being placed on either side of the main axis, there will be ready means for dunging out into this yard from every occupied part of the building. The provision of communication between cowhouse and boxes would certainly be convenient for moving a sick animal and need not be used unless required.

The cart-shed and barn are very much as shown on the original plan, but provision is made for internal access to the loft, which, continued over the stable and loose box, would give more ample storage accommodation demanded by the



FIG 2.—Front view of Farm Building at Hexhamshire.

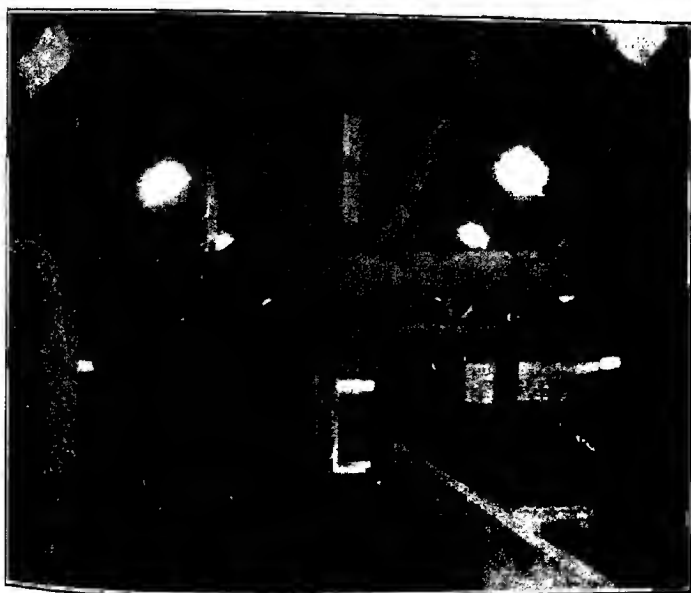


FIG. 3.—Interior view of Farm Building at Hexhamshire.

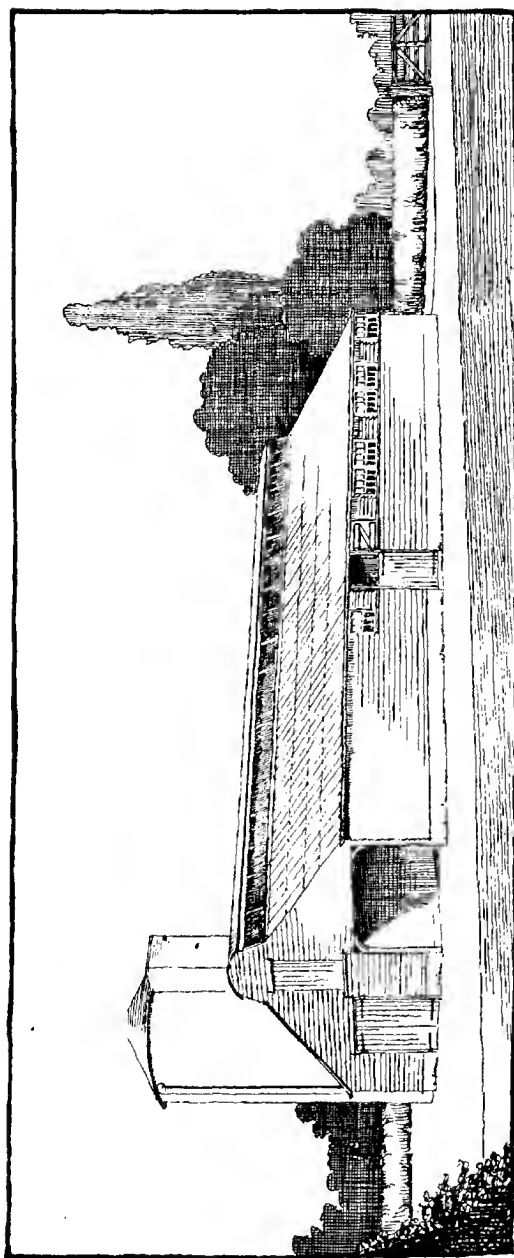


FIG. 5.—Perspective view of suggested Standardisation of Hexhamshire Farm Building.

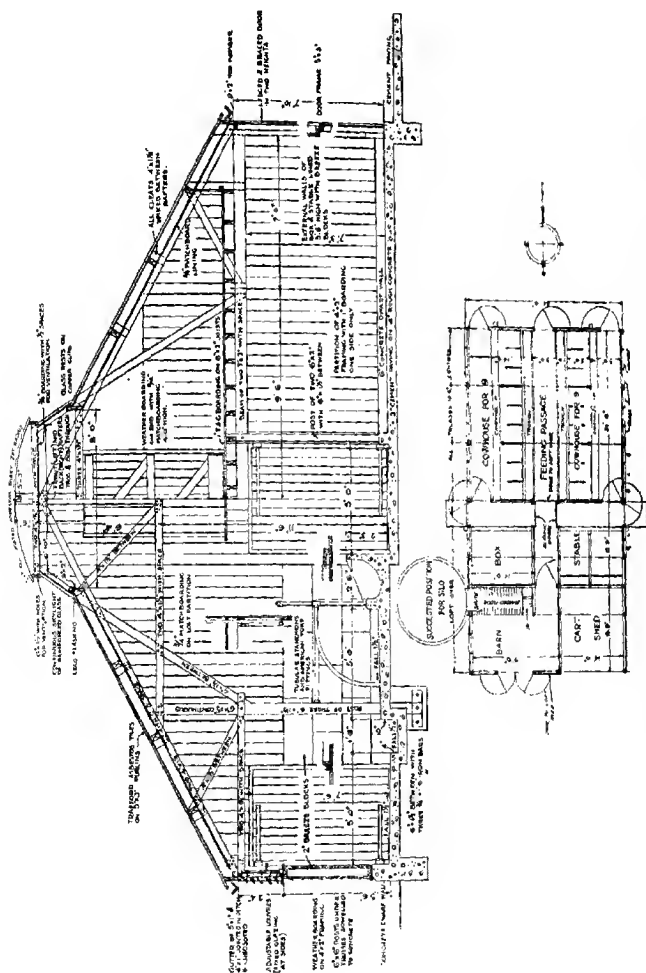


FIG. 4.—Plan and Section of suggested Standardisation of the Hexhamshire Farm Building.

increased head of stock. The cart-shed space can be utilised to accommodate a tractor, which would operate shafting secured to the back wall of the cart-shed and barn for working machines either on the ground floor in the barn or in the loft above.

Provision of Silo.—The plan indicates where a silo could be conveniently situated so as to deliver direct on to the boarded floor of the barn, and where it would not interrupt any extension of the building by the addition of one or more bays at either end.

Construction.—The revised scheme shows the same type of timber construction advocated for large cowsheds described and illustrated in the articles published in July and August last. In this case the construction has been utilised to form continuous top light and ventilation, thus enabling the remainder of the roof surface to be covered without cutting the material for sky-lights. The advantages of this method were described in the former article, and in the event of some form of corrugated sheeting being used for the roof, would undoubtedly be a material improvement. The construction is practically the same throughout, except that there are slight modifications in the internal members of the roof trusses where these occur in the loft in order to make more space and head-room.

Cost.—The complete building without the silo cubes out at 83,200 cu. ft. and at present prices in a reasonably good building locality should not cost more than £1,000, or a fraction over 7d. per cu. ft. This estimate, however, does not include special fittings or machinery. It should be noted that the Hexhamshire estimates were for five buildings and that the contractor was provided with special facilities for getting certain materials on the site and on favourable terms.

We cannot conclude this article without expressing our thanks to Mr. Ker for his kindness in supplying plans and information, and we hope that the illustration of the Northumberland building and the suggested amendments will prove of value to practical farmers.

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THE AYRSHIRE COW.

MISS A. D. BRIGHT.

THE Ayrshire, the essentially Scotch milch cow, a few years ago was something of a stranger among southern show-goers, so that on both sides of the Border it was almost forgotten

that before Waterloo this dairy breed was in great demand in all parts of Great Britain. Quite recently there were show-goers in England who regarded this breed as almost an alien. Only three years ago the pedigree Ayrshire, her performances and her special attributes, had little interest for frequenters even of the big shows, while there were parts of the south and west of England to which she rarely penetrated. "She is a poor man's cow in Scotland" was a comment overheard at the 1921 London Dairy Show, "and she would not at all suit good English pastures."

The Ayrshire, one of the best of cows for poor land, is not by any means exclusively a poor man's cow. "She is a verra sound commerial proposee-tion" drawled one of her successful breeders, when the so often quoted remark was made in his hearing, "and she is mebbe a guid beast for a puir man, for if she taks him in haun, he needna be sae puir for lang."

After seeing her at home, or as she appeared at the Royal Shows of 1921 and 1922, the visitor to Ayr pastures has ground for some surprise that the Ayrshire is still undoubtedly within the reach of modest means, and that it is possible for small men to maintain excellent families of the breed with their places in the Herd Book, even though notables among pedigree stock are in demand with buyers who pay record prices in four figures. This is possible because it is difficult to escape pedigree in an original breed, living so long in its own counties that selection is easily watched.

Though in Scotland as in England, there have been introductions of Dutch blood, the Ayrshire in her evolution is essentially Scotch, closely resembling no other British breed and no European one. She was Scotch as the Kyles in 1793, as one of the "Black Cattle" in 1806, as the Dunlop in 1814, and as the Cunninghame a year or two later. By the middle of last century when she was simply the Ayrshire she had changed her colours and markings several times, but in appearance, in attributes, in disposition she was as purely Scotch still as the successful farmers on whose acres she had been evolved. No breeding seems to bring her to the English Shorthorn type, although the effect of the Ayrshire cross very often will give the Scotch model to an English herd.

The Ayrshire is still developing and in her development she affects striking colours. Chiefly now she is white with brown cheeks, or white with brown markings on cheeks and body. In one phase she passed through she was too undeveloped to be

easily milked, but she is to-day one of the most beautifully formed of milch cows, and during twenty years of milk recording has developed milking powers together with a uniformity of outline and conformity to type that would astonish those breeders of the Kilmarnock Farmers' Club who first set themselves to improve the national breed.

It is not claimed that the Ayrshire cow is a phenomenon; in milk production she does not rival the Friesian; in butter fat production she is not equal to either of the Channel Island breeds; but there is no cow in Britain that has done better on sparse pasture. There is no cow in Europe that more quickly adapts herself to extremes of climate or to changes of conditions. This hardihood became hers in the infancy of the breed when the south-western counties of Scotland had not developed into the smiling countryside of to-day, and it is maintained by the bracing climate and conditions that still rule in her homeland.

The world over, reliability is recognised as distinguishing the production of the Ayrshire. She is hardy and tractable; she is built on a very fine model and her performances are as good as her lines. In Canada and the Kenya Colony, in Finland, in China, Sweden and New Zealand, she thrives on second-class land and improves the yield of second-class herds. She was established as a favourite in Australia years ago, and though, through causes which no longer exist, the breed for a period lost ground, it is now recovering popular favour rapidly.

As a family or as a herd the Ayrshire has not yet equalled the performances of the greatest Friesians; it is doubtful whether centuries of breeding could give her the elegant lines of some Jerseys, or the handsome Shorthorn head. It is absurd to compare and contrast the Scotch cow with the Friesian, the Dairy Shorthorn, or the Jersey, or to declare one breed finer than another. Each geographical district confers on its own herds and flocks special attributes. Still the Ayrshire's head is a fine one—none more intelligent—and her lines, while proclaiming her milking powers, make her particularly alert. Her performances at the Shows in 1922, especially the London Dairy Show and the Royal Show, at which she competed with English herds, tell a tale of milking powers that is not only interesting but immensely illuminating, both as regards the breed itself and as touching the value of consistent and systematic milk recording, of which her present fine uniform average yield is the result. As a whole, at those two shows

no exhibit did what they set out to do more consistently than the Ayrshires. The breed essayed to prove itself in the milking trials, and at one show out of 15 Ayrshires entered for the milking trials, 12 actually competed, and of these none failed to pass the necessary tests for butter fat.

Again, in those same trials, out of the nine of one breed competing, only three got through the test; out of another six only two emerged with honour; while every heifer in the Ayrshire section received her card—an achievement that is probably unique. That an Ayrshire took the championship in her own class (Grade B) with a total number of points not attained by any member of four of the breeds in Grade A, was pleasant news for the exhibitor. Such individual performances, however, have not much educative value; exceptional beasts give no more data as to the potentialities of a breed than does exceptional genius offer any guide as to the mentality of a nation. When combined performance becomes exceptional and when such combined performance is repeated, here is achievement that has a lesson for every looker-on.

The Ayrshire, however, in her individual performances, is not uninteresting. She has attained the 2,000-gal. limit (milked twice a day) in America as well as on her home pastures. She has not lost the habit of her grandmothers of producing a calf every year. Her milk is specially adapted to the making of cheese, and in London Ayrshire men secured most of the honours for Cheddar. Again, however, the usefulness of the breed is not to be found in pedigree herds alone, nor are its praiseworthy performances to be recorded only from these.

Ayrshires were represented in 1921 at the London Dairy Show by two cows, one of them picked up in open market in Ayr just in time for entry. She came her 500-mile journey in fine condition and was in all ways a singularly attractive little beast (non pedigree) with an inquisitive, clever head and alert movements that made her particularly noticeable in that hot, October week. A big entry of any class at the London Show brings with it a certain number of show-goers, and most of the British representative breeds had their attendant owners. The Ayrshire apparently had none, but she had food, which in spite of the heat she never ceased to chew, and all the while, as she munched, she kept turning her head, here, there, everywhere. She was not in the least perturbed by her surroundings, but her inquiring eyes had to see all that went on. She came

fourth in the milking trials that year against all comers—Friesian, Dairy Shorthorn, Red Polled, etc.—without any preparation and with no particular care at a time when the railway journey was not so well managed as it is now. Seeing this, it is not at all certain that her performance was not as good as that of many of the pedigree Ayrshires coming to London in 1922.

Visitors to Baltic lands agree that the great usefulness of the many dairy competitions in Denmark is to be looked for in the standard they set, not to be maintained but to be trodden down. Always a record is made to be broken, and this again not by single members of individual herds but by the whole country in its national and amazingly representative average. In this ambition of the Danish dairy farmers the men of the Ayrshire counties join issue. Never was a 2,000-gal. cow less advertised than Tosh, who made that record, has been. She is not even specially shown at the Hobbsland Farm. For here and in most neighbouring establishments great milkers can be found, giving, year after year, results quite as satisfactory without the element of danger that attends abnormal yields.

The district of the Ayrshire cow, the standard of efficiency maintained at the byres where she is milked, and her performances as recorded at the Shows should be studied together. When taken separately, with one exception, these aspects in her evolution lose significance. The exception is her appearance in one of the events of the February Show at Ayr, entailing a far severer test than any faced at bigger functions. This was the parade of the 1,000-gal. cows. In this class, sixteen entries, all certified to have produced over 1,000 gal. of milk averaging not less than 3.5 per cent. of butter fat in any one lactation, exhibited such uniformity that at the end of the row number sixteen would have made an excellent second if the intervening entries had not been in their places. Very few Southerners were present, which was a pity, for no British farmer, whether Scot or Englishman, could fail to be proud of this extraordinarily noble assemblage of splendid milch cows, as essentially British in character as are the contours of the countryside that produces them.

Without any unique performance, however, the Ayrshires, whether appearing at shows, or in milking herds at home, or as crosses facing hard conditions in overseas lands, are now happily recognised by English critics as "a very good lot," and it is realised that in the interests of progress, the breed should

not be overlooked anywhere where excellent performance is to be provided at the minimum of cost on lands that, at their best, are only medium.

FRIT FLY ON OATS IN THE FOUR NORTHERN COUNTIES.

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It is only during recent years that farmers in the north have begun to realise the magnitude of the losses in the oat crop caused by the larvæ of the Frit Fly (*Oscinis frit*). There is no reason for supposing that these losses have been increasing owing to a greater prevalence of the pest in the northern counties, especially when one considers that damage done by Frit Fly has often been attributed to wireworm, eelworm, etc. As recently as last summer some fields of oats, reported as suffering from an attack of wireworm, were, on examination, found to be infested with Frit Fly.

A concise description of the insect, and a general account of its life-history have appeared already in the *Journal*,* and the subject of Frit Fly is dealt with in detail in the Ministry's Leaflet No. 202, but, for the benefit of north-country farmers, it may be well to give here an outline of the main features of its life-history, as relating, in general, to the northern counties.

Life History.—Although there may be a good deal of variation in the times of appearance of the broods, and even in their number, observations have shown generally that there are three main broods of flies in the year, and that the first brood appears on the wing in May, or, if the weather conditions have been particularly favourable, towards the latter half of April. The female flies of this brood, after mating, lay their eggs on or under the leaf-sheaths of the young (spring-sown) oat plants, the number of eggs laid by a single female being variously estimated at from twenty to seventy.[†]

* "The Frit Fly," R. Stewart MacDougall, D.Sc., *Journal*, Aug., 1907, Vol. XIV, p. 297.

† See "A Short Summary of our Knowledge of the Frit Fly," by J. E. Collins, F.E.S., *Annals of Applied Biology*, Vol. V, No. 2, October, 1918, p. 81.

The small, white legless larvæ or maggot, issuing from an egg, eats its way to the centre of the plant, upon which it feeds, with the result that the young central shoot turns yellow or yellowish-brown. This withered appearance of the central shoot, though the outer leaves may be healthy, may be taken generally as a sign of Frit Fly attack, and should be specially noted by the farmer. If the maggot is still present, it will be found readily in May and June, by carefully exposing the central shoot, and breaking open the rotting portion usually seen as a result of the attack. When full-fed the maggot changes to a pupa inside its larval skin, forming what is called a "puparium." These brown puparia usually remain within the sheathing leaves for some time after the fly has emerged, and so form a good indication as to the cause of the damage, when other signs are not apparent.

From these puparia the flies of the second brood emerge in July and the beginning of August, when eggs are laid on the ears, or on the sheaths enclosing the ears, and, after passing through the changes already described, the flies of the third brood appear in August and September. These flies now lay their eggs on grasses, and on autumn-sown oats, if the latter are available and at a suitable stage of growth. The maggots hatching from these eggs make their way to the young central shoots, but, unlike those of the previous broods, they remain as maggots throughout the winter, changing into pupæ in the following spring, thus giving rise to the first brood of flies referred to above as laying their eggs on the young spring-sown oats.

Observations in the Northern Counties.—In the course of a considerable number of advisory visits to farms in the north during the past season (1922), observations continued to be made on the general occurrence of Frit Fly. At one centre (Newton Rigg, Cumberland), an attempt was made to estimate the percentage of attack on twenty-seven varieties of oats at an early stage of growth, with the object of ascertaining any subsequent signs of recovery that might indicate special powers of resistance to attack in any of the varieties.

The earliest sign of appreciable damage was on 22nd April, when Frit Fly larvæ, completing their winter stage, and commonly associated with grasses as their habitat preparatory to the emergence of the first brood of flies of the year, were found at Cockle Park, amongst Great Mogul oats (sown Nov., 1921). These oats, though normally spring-sown, were used in this field

as winter oats, and were growing alongside a portion containing Winter Dun oats sown on the same date. These latter showed no signs of Frit attack, probably owing to the stronger growth to be expected from an oat normally winter-sown, as compared with Great Mogul. The larvæ examined varied much in size, and the emergence of the first brood of flies for the year must have been very irregular, a result which was perhaps encouraged by the backward and wet weather prevailing in February and March.

In spring-sown oats, the larvæ of the first brood of flies were feeding on young oat shoots by 10th June, on which date, at Cockle Park, Great Mogul, Victory, Black Bell, Yelder and Canadian Western were all affected. During the last week of June these larvæ of the first brood were pupating in oats in Northumberland and Durham, thus giving rise to flies of the second brood of the year, the larvæ from which were to be found in late tillers, and in the young ears, during July. A few puparia were found on 21st July, attached to exposed ears of Canadian Western oats at Cockle Park. The presence of these puparia, while maggots in various stages of development were numerous, pointed to irregularity in the time of emergence in the case of the second brood of flies also. The earliest emergence amongst a few of the puparia kept in a cool room was on 6th August, but adults were not observed in the field in any numbers till the third week of that month, thus indicating the latter half of August as the main period of emergence of the third or autumn brood of flies.

"Blind" Ears in Oats.—In Cumberland arrangements had been made with Mr. Lindsay Robb, Principal of the Farm School, Newton Rigg, to begin an investigation to determine the comparative powers of resistance to Frit attack shown by different varieties of oats. A general survey of the extent of attack on twenty-seven varieties (sown on 3th April) was made on 29th June, in the course of which larvæ at different stages of growth were still plentiful, but, on that date, they were most numerous above the second and sometimes the third nodes, and in the unopened panicles. These latter, on being examined, revealed the so-called "blind" spikelets suggested as being caused by a brood of flies, intermediate between the dying off of the tillers, and the attack on the grains.*

The presence of these "blind" ears has been very prevalent in Frit-attacked oat fields, generally, in the north, and they

* "Frit Fly in Relation to Blindness in Oats." A. Roebuck, *Annals of Applied Biology*, Vol. VII, p. 178.

must have accounted for a considerable loss of grain in the aggregate of the crops. During the past season there was evidence of much overlapping of the broods, and it is quite possible that this overlapping may have reached the extent of forming an extra brood which would account for this form of damage.*

Early Sowing.—Inquiries made at farms, particularly in Northumberland and Durham, have generally confirmed the advantage of early sowing (on a good tilth) for avoiding Frit Fly attack. In most cases, oats sown in the beginning of March largely escaped damage, the individual plants having got well forward, with the result that only a few small side-shoots were attacked. On the other hand, oats sown in April or the beginning of May invariably cut thinly. This was confirmed at Cockle Park, where trials were commenced in 1920-21 to test the advantage of early, as compared with late sowing against Frit attacks. The trials were continued in 1921-22 and showed similar results.†

Mr. Robb informed the writer that it is a common belief in Cumberland that oats grown after turnips suffer more severely than when grown after ley. In Northumberland and Durham, the attacks appear to be equally serious, in so far as the writer has observed. Where, however, this condition occurs, it may be due to late sowing following the removal of a root crop.

Extra Seeding.—An interesting observation which appears to justify extra seeding as a precaution against loss of crop from Frit attacks was made in a field of Longhoughton oats in Co. Durham, in which the seed drill had gone round the sides of the field three times, and then across and back on the remaining inside portion. Where the extra seed had fallen in the process of turning, the oats stood out as two conspicuously good strips in the crop, which was otherwise thin, and badly attacked by Frit.

Preliminary Trials of Recovery from Frit attacks amongst varieties of Oats.—Reference has been made above to these trials which were carried out in Cumberland in conjunction with Mr. Robb. Twenty-seven varieties of oats, sown on 5th April, at a rate equivalent to a seeding of 3,000,000 grains per acre for each variety, and grown under the same conditions on conveniently wide lengths of a field at Newton Rigg, were

* See "The Frit Fly on Oats," T. H. Taylor, M.A., Bulletin No. 108 (Leeds University).

† See Guide to Experiments at Cockle Park, 1922, p. 32.

examined on 29th June, 1922. \ For each length of plot the approximate middle line was chosen, and the writer walked along this, stooping down after every two or three yards and examining the plants in about a foot length of the drill. At intervals a similar examination was made in drills at varying distances from the central line. In each a note was made of the percentage of damaged plants. At the same time Mr. Robb made a general survey of the plot, and at the end of each examination notes were compared.

More accurate results might have been obtained by digging up the plants from every foot-length examined and taking counts of these in the laboratory, but considering the length of the plots such a procedure would have involved enormous work for which time did not allow. As it was, the frequency with which Mr. Robb's estimates coincided very nearly with those of the writer was encouraging.

Although, obviously, one cannot deduce anything definite or of general application from observations made for only one year in one particular locality, yet the results are useful as affording a preliminary indication as to the likelihood that certain varieties of oats possess superior powers of recovery from initial attacks of Frit Fly.

For example, Crown and Ascot had an estimated extent of attack on 29th June of as much as 50 to 60 per cent. Later, however, both made an excellent recovery, so that judged by the yields of grain alone they came out best on the list. Even English Banner, the most severely attacked amongst the varieties in the early stages of growth, improved greatly in July and August and gave no mean yield of grain.

On the other hand Potato, Sandy and New White (1922), showing 50 to 60 per cent. of damage on 29th June, could not apparently "grow away" from this severe early attack, in so far as yield of grain is concerned. The proportion of yield of straw, however, in these three is relatively high, a fact which may be accounted for by the good tillering properties possessed at any rate by Potato and Sandy.

Golden Rain (30 to 40 per cent.) made a good recovery as compared with either Canadian Western or Sir Douglas Haig. Sir Douglas Haig, especially, a poor tillerer, went off at an early stage of growth, and though it showed signs of slowly recovering, its resistance against Frit attacks appears to be much inferior to that of Golden Rain.

With regard to the varieties with an initial extent of attack estimated at 40 to 50 per cent. all recovered well except Black Tartarian, and Mr. Rohh reports that Yelder "did not make the rapid recovery that one might have expected from an oat of its good tillering properties, but it gradually improved and would undoubtedly have taken a higher place in the list, but for the fact that it was severely attacked by sparrows."

Conclusions from Observations and Trials.—(1) Observations during the past year have almost always shown the advantages of early sowing as a preventive. If the land can be got into good order for spring sowing of oats, these should be sown in March rather than in April.

(2) Autumn-sown oats are to be recommended in place of spring-sown in places where the latter have gone off yearly on account of Frit Fly. In some parts of county Durham winter oats are gradually replacing spring oats.

(3) Extra seeding of spring-sown oats has been observed to give good results, and is worthy of consideration.

(4) It seems likely that certain varieties of oats suit certain districts as regards their power of recovering from Frit Fly attacks. Farmers in the northern counties should note especially what varieties appear to escape damage, say, by observing crops on neighbouring farms that have escaped, seeing that the preliminary trials described above must be repeated and perhaps modified before definite advice can be offered on this point.

(5) Even these varieties may suffer to some extent in yield of grain from late attacks of Frit, but a relatively large yield of straw is likely to compensate much for such loss in grain.

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THE TRAP NESTING OF DUCKS.

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UNTIL quite recently the claims of the duck as a profitable producer of eggs were largely overlooked by the majority of poultry keepers. This is probably attributable to the fact that for profitable production from any large number of ducks, considerable land is desirable in order to provide the necessary conditions.

Ducks appear to require natural exercise and natural food to a larger extent than fowls if they are to produce eggs at a profit,

and for this reason they seem to be far better suited for the conditions of the general farm than for the more intensive and artificial conditions under which fowls are now kept in such large numbers.

It is true that for many years the Indian Runner duck has been recognised as a heavy layer and that this breed has been kept by farmers, mainly in the North of England, for the purpose of egg production. The farmer, however, has usually been the last class of person to recognise the commercial value of any sort of poultry, and hence the progress made by the laying duck has been slow and its merits have been obscured by those of the laying hen.

Advent of the Trap Nest and of Laying Tests.—Had it not been for the introduction of trap nesting and of laying tests for ducks, with the consequent publication of records which can be generally accepted as coming from unbiased sources, the attention now drawn to duck keeping for the production of eggs might have been long delayed.

One can recall many claims made by individual duck keepers as to the large numbers of eggs produced by their birds which when made did not receive the attention they merited, owing to lack of evidence such as that given by trap nest records. So far as is known no attempt was made to establish these claims until 1917, when a test of a semi-official character was arranged by Mrs. Upjohn, an enthusiastic duck keeper and member of the Utility Duck Club, which received the recognition of the National Utility Poultry Society.

Following this, duck breeders were fortunate in securing the interest of Mr. J. N. Leigh, manager of the National Utility Poultry Society's Laying Trials, and a duck section was included in the National Laying Tests held on the Great Eastern Railway Farm at Bentley in 1920-21. The provision made by Mr. Leigh for this test was most practical and complete. The results were extremely good and immediately attracted public attention. A marked improvement was shown in the results of the second test held under the same conditions and management in 1921-22, and the tests now proceeding promise further interesting results.

Trap Nesting.—As the duck almost invariably lays her eggs during the night or in the early hours of the morning, trap nesting is greatly simplified. In so far as labour is concerned the trap nesting of ducks is a far easier matter than that of

fowls and it is only necessary to make provision for the separation of the ducks at night time in order to keep the laying record of each individual. This can be done without the aid of the trap nest, but the addition of the automatic trap is a great convenience, as it saves labour and causes less disturbance to the ducks. Trap nests of the type used for fowls are suitable also for ducks. The wire release-catch, which the bird carries inwards upon entering the nest, with the drop door from above, is probably the most convenient trap for ducks, which will quickly become accustomed to it.

In the plan adopted at the laying test a separate small hutch, consisting of a nesting box in which the duck sleeps at night and an open run where the bird is fed, is provided for each duck. The trap is fixed at the entry to the run so that only one duck can enter a compartment. Two long rows of these hutches are placed on either side of a broad yard, into which the ducks are allowed at feeding time, and, passing down on either side, they enter the traps, are fed in the runs and remain until the following morning. A similar plan is followed for the sleeping and recording of their ducks by some breeders, but in a method adopted by others a house is used with compartments down either side for the ducks and a gangway down the centre for the use of the attendant. The gangway can also be utilised for the accommodation of other birds which are not being recorded.

The plan of a house of this type used by one noted breeder is illustrated in Fig. 1; this is 10 ft. long, 6 ft. wide, and 6 ft. 6 in. falling to 5 ft. in height, with a roof of lean-to type. There is a range of nine divisions (nests) on each side of the house, with a gangway between of 2 ft. 6 in. The divisions are of netting on wood frames, with light frames laid on top to prevent the ducks escaping and for removal for attendance when trap nesting. Shutters on the outside are used to cover the entrances to the nests at night time. The whole of the interior fittings are easily removable, so that the house can be used for a flock of young birds or an unrecorded flock of adults. This house is especially designed for a breeding flock and for recording the eggs; the accommodation is for 18 ducks, and the drakes which complete the flock sleep in the gangway. The dimensions are unusual for a duck house; it is, however, intended for a special purpose, and the height, which affords convenient room for the attendant, adds to the airiness of the house and the general well-being of the birds. The arrangement of the nests and

the ease with which they may be removed to facilitate cleaning are also points which have been carefully considered in the design of the interior fittings.

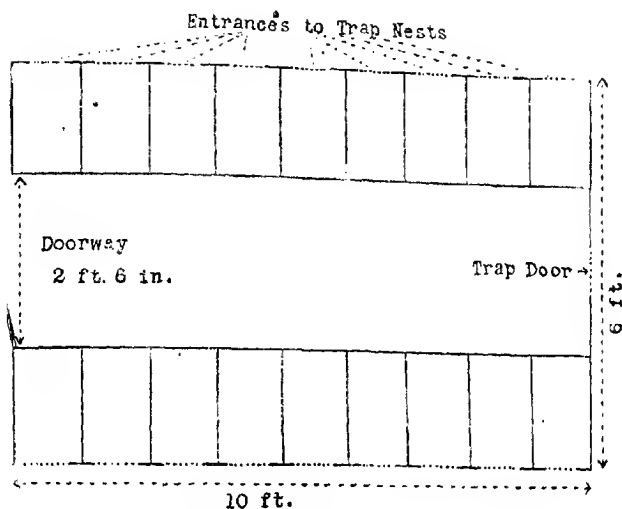


FIG. 1.— Plan of Duck House designed for Recording with Trap Nests.

In trap nesting ducks, the birds are frequently fed inside their compartments, as at Bentley, and are trained to use the traps in this way in the first instance, but it is not necessary to continue the practice, since when accustomed to using the traps they are easily induced to enter at evening time without food. It is also curious to note in a flock which is mated for breeding, how the drakes separate and enter the door of the house to sleep in the gangway, after the ducks have disappeared into the traps.

Trap Nest Records.—Some very remarkable individual results have been obtained in the duck tests. One bird which laid 294 eggs in the 44 weeks covered by the Bentley Test in 1921-22 was retained for the completion of a year's record, in which time she laid 350 eggs. This bird was a fawn and white Indian Runner. Two other ducks of Khaki Campbell breed gave the high records of 323 and 303 eggs in 365 days, the former laying 201 eggs without a single break. These birds formed part of a pen of 5 ducks which laid an average

of 276 eggs per bird in the year, while another pen of this breed averaged 237 eggs per bird in the 308 days of the original test.

High records are not confined to any one breed of ducks, since individual ducks of the Buff Orpington, Coaley Fawn and White Runner breeds contributed records of 287, 246 and 248 eggs respectively in the 308 days' test. It is, however, interesting to note that Indian Runner blood has been utilised in the formation of the other breeds mentioned.

Breeding and Management.—How far the rapid improvement attained in production from the laying duck may be due to selective breeding or to experienced management it is impossible to say. It is interesting to learn that the record layer of 350 eggs in a year was the offspring of a duck which laid 205 eggs in the 9 months' test in 1917-18, mated to a drake bred from a layer of 320 eggs in twelve months sired by a 314-egg pedigree drake.

On the other hand, a study of the weekly returns of the Bentley flocks provides an interesting record of the progress which is being made in management.

In the 1920-21 test (48 weeks) 220 birds produced an average of 160 eggs per bird, while in the 1921-22 test (44 weeks, 265 birds) the average was 175 eggs per bird. This improvement is even more marked in the returns to date of the 1922-23 test. Moreover, the improvement in laying has taken place principally during the winter months, when eggs are most profitable. The credit for this improvement is largely due to, and serves to illustrate the value of, skilled management. The average poultry keeper, however, who is successful with fowls should have no difficulty in succeeding with laying ducks; but there are points of difference in management which require to be studied.

The timidity of ducks is not always sufficiently recognised; the birds are very easily upset by anything out of the ordinary, and need to be quietly handled. Instances are given where production has ceased owing to the trimming of a hedge round the duck pen, to fright caused by aeroplanes and to other unusual happenings. On the other hand ducks rapidly respond to gentle and regular treatment and become very tame. Regularity in feeding and attention is most important. Feeding is simple, as the ducks will find naturally a large proportion of their own food, and do not require much variety in food or

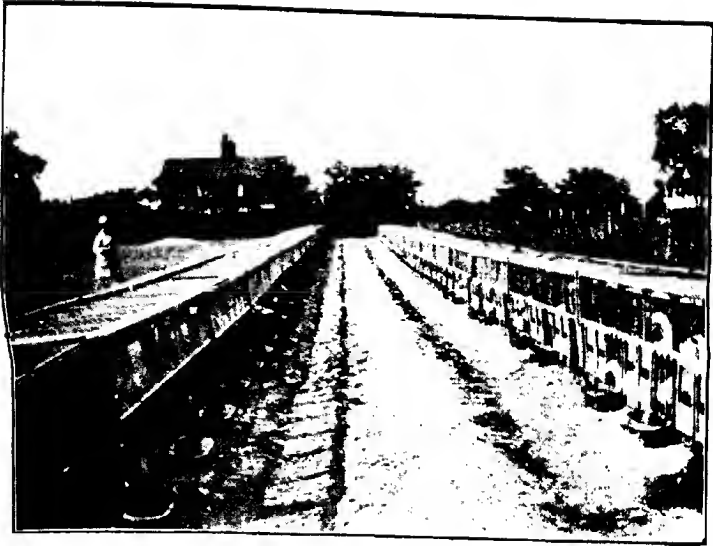


FIG. 2.—Range of Duck Pens, showing passage from which the Ducks enter the Trap Nests.

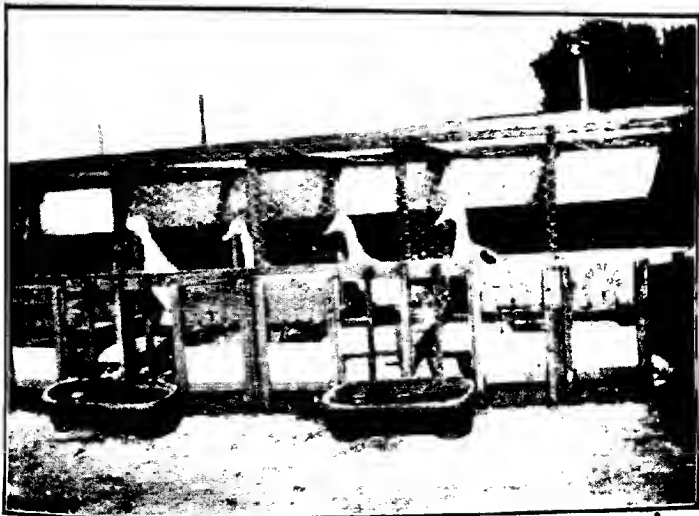


FIG. 3.—Set of Trap Nests, showing Pen and Nests.

any greater quantity than laying hens, provided they are given a good range.

While it is important to note that when housed at night, dry, clean bedding must be supplied to ducks, the experience of at least one well-known breeder is well worthy of mention. In this instance, houses are considered unnecessary, the ducks being allowed to sleep throughout the year in open pens, into which they are driven at night time for protection against ground enemies and for facilitating the collection of their eggs. Production under these conditions is most satisfactory, as evidenced in one case in which an average of 284 eggs was obtained from a flock of 7 ducks in 12 months. A considerable saving is effected in outlay and in labour without the provision of houses or the necessity for cleaning.

No doubt a great deal has yet to be learned in the breeding and management of ducks. The extension of duck keeping and the addition of sections for ducks at other laying tests is bound to throw fresh light upon the subject. Fruit growers may anticipate useful information as a result of the test in progress at the South-Eastern Agricultural College, where the ducks are running under fruit trees. The investigations with fowls already made at the College have served to prove the value of poultry keeping to fruit growers by drawing attention to the great quantity and variety of insect pests which are destroyed by poultry.

The writer is indebted both to the Secretary and to members of the Council of the Utility Duck Club for information and illustrations. It is a special aim of the Club to bring duck keeping to the notice of farmers and to assist them to secure reliable stock and information on the management of ducks.

Duck keeping has many points in its favour for the general farm, and as an alternative to fowls on some farms ducks are to be preferred. If it is to be successful, however, duck keeping—like other farm projects—requires to be carried out upon a well organised plan.

CROPS AND PLANT BREEDING: RESEARCH METHODS IN NORTH AMERICA

II.

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Grassland and Sward Problems.—The famous Blue Grass* pastures so prominent in Kentucky and other States are very different from the fattening pastures of this country. The sward is not nearly so dense and the productivity not so great, as it apparently takes about three acres to fatten a beast on even the best of these pastures. It is interesting to find that erroneous ideas on stocking are current in regard to these pastures just as in relation to our grasslands. Thus Lyman Carrier and R. A. Oakley* have shown that relatively heavy grazing gives better results than light grazing and has an altogether better influence on the quality of the sward.† Since these swards are not dense it is not surprising to find that dragging with a heavily tined implement has not the ameliorating influence on the Blue Grass pastures that it so commonly has on our dense and matted swards.

Derelict grassland is a great problem in America, for cropped out land when let out of cultivation does not so rapidly produce a tolerable sward as in this country, and the vegetation of these pastures is heterogenous to a degree, although eventually blue grass may establish itself satisfactorily while the indigenous range grasses (e.g., *Andropogon*, spp.) are exceedingly poor re-colonizers.

It is worthy of comment that white clover is usually fairly abundant in good blue grass pastures, and in certain years becomes almost a dominant plant, while it may be encouraged by dressings of ground lime on derelict areas to a wonderful extent. The readiness with which white clover responds to lime (even comparatively small dressings) is probably largely due to the earthy rather than dense nature of these swards. It is somewhat remarkable that blue grass has become so particularly

* See Lyman Carrier and Oakley, R. A., "The Management of Blue-Grass Pastures," Bull. 204, Virginia Agr. Expt. Station.

† Cook (Bull. 177, Agric. Expt. Stat. of West Virginia) points out, however, that the grazing should not be heavy until growth has fairly started, and heavy grazing should not be continued into the autumn.

aggressive and that it has not been accompanied by several other species of European grasses, such as crested dogtail. The paucity of the flora on the best blue grass pastures was very striking. Ribgrass was fairly common and sometimes red top; Crested dogtail was not once seen, and it is stated to be a rarity in the United States despite the fact that thousands of pounds of seed are sown annually. Indeed it is evident that the American farmer is often as prodigal in sowing species in his mixtures which are foredoomed to failure as is his British cousin. The type of mixture recommended to establish a blue grass pasture is usually as follows: 10-12 lb. blue grass, 4-5 lb. Timothy, 2-3 lb. white clover, sometimes with the addition of 2-3 lb. Japan clover, to which 2 lb. of all or any of the following are sometimes added: Red top, orchard grass (cocksfoot), red and alsike clovers. Meadow foxtail has also been tried with promising results.

Cocksfoot (= American orchard grass) when sown in large amount is now to some extent finding favour as a pasture-forming grass.

Opportunity was afforded of inspecting some of the range grasslands of Kansas and seeing the interesting investigations being conducted by Professor R. L. Hensel of the Experimental Station, Manhattan. One of the chief problems of these grasslands, which are natural types of vegetation, is to maintain a good gramineous sward—the position is here very different from that of the blue grass pastures and of our own dense-swarded grasslands, and deterioration tends to follow from heavy grazing, the chief reason apparently being that it is necessary to allow the grasses to re-seed. Unfortunately the *Andropogons* of the ranges are very poor seeders. Herefords are chiefly used on those ranges, being fattened on the pastures with the addition of cake.*

Fundamental Research.—Federal funds allocated to agricultural research are not by any means only confined to the solution of problems such as the average practical man would deem to be of obvious economic importance; this fact is well exemplified by the character of many of the investigations in progress, and by none more so than by the work of Drs. Garner and Allard on the effect of the length of day on the flowering and fruiting of plants. These important investigations are being conducted at Arlington Farm, and have already proved to be of profound

* More detailed particulars of Professor Hensel's work are not given as he has not yet published a full report.

economic significance. It is obviously a matter of importance to the farmer to know that the time at which his crops come into flower is under ordinary field conditions affected to a considerable degree by the length of the day, and that different crops and different varieties of the same crop make very different demands on this ever operative factor of the environment. The reader is referred to the authors' papers for details of the investigations* but reference may be made to at least one tangible benefit to the American farmer as a direct result of the work. In Maryland is grown a mammoth tobacco which develops to an unusual size; it, however, does not flower in the field in that locality—or it flowers too late for the seed to mature properly. In the greenhouse this tobacco flowers freely under the ordinary day length of winter. The reason for it not flowering in Maryland is because the summer days are there too long. The problem of producing seed of this variety has therefore been solved by growing the plants specially for this purpose during the winter in the south of Florida.

Plant Breeding.—The importance of disease-resistance as it affects yield and quality is fully appreciated by the American plant breeder. It is probable that disease accounts for a greater average reduction of crop per unit of area in the States than in this country, and this not so much on account of any greater virulence of the disease organisms as on account of the much larger contiguous areas under one and the same crop, which would seem considerably to facilitate infection. Breeding for disease-resistance consequently takes a prominent place wherever plant breeding is in progress. This is work particularly amenable to co-operative attack and to a thoroughly well organised system of recording and tabulating results, and is again work that is only possible by resort to numerous small scale trials conducted over the widest possible area. Thus we find Dr. C. E. Leighty of the Bureau of Plant Industry co-operating with Dr. Mains in the prosecution of researches conducted at seven different stations relative to strains of wheat resistant to Leaf Rust (= Brown Rust, *Puccinia triticea*). At many of the Stations elaborate researches are in progress with a view to breeding strains of cereals resistant to both insect and fungus attack.

* See Garner, W. W., and Allard, H. A., "Flowering and Fruiting Plants as Controlled by the Length of Day." Separate No. 852: Year Book U.S. Dept. Agr., 1920; and "Effect of the Relative Length of Day and Night and Other Factors of Environment on Growth and Reproduction of Plants," in Journal Agr. Research, Vol. XVIII, No. 11, March, 1920, also "Photoperiodism, the Response of the Plant to relative Length of Day and Night." Science, n. ser. LV (1922) No. 1431, 2nd June, 1922.

The work conducted by Drs. L. E. Melchers and J. H. Parker at Manhattan, Kansas,* affords an excellent example alike of the progress being made in this direction and of the well conceived field, greenhouse and laboratory technique that has been developed in order adequately to carry out these researches.

Four important points, all of which have their bearing on methods adopted in this country, emerge from discussion with the men actively engaged on this important branch of research: (1) The necessity of intimate co-operation between a plant breeder and a mycologist. (2) The local nature of the problems involved—speaking broadly it does not follow that a strain resistant to a disease (especially in the case of rusts but not necessarily only rusts) in one locality will be equally resistant in another. Thus, in its disease relationship, plant breeding is essentially a local matter. This is strikingly so in a huge country, but evidence is not lacking to suggest that in disease and other aspects plant breeding may advantageously be further localized even within the confines of Great Britain; or in any event that strains and segregates should be tested over widely different habitats. (3) Even in the case of diseases which are preventable by the adoption of remedial measures (*e.g.*, bunt and smuts of cereals) it is more economical to grow resistant strains than to rely on measures that will never be everywhere put into practice. The evidence which is rapidly accumulating appears to indicate that, given time and facilities, it should be possible to produce strains highly resistant to all the diseases which take such a heavy annual toll from the crops of the world. (4) The necessity of having not only a means of distributing rapidly new strains as they are produced, but also the means of withdrawing from cultivation the older strains which the newer strains should replace. This is an important and exceedingly difficult matter, for as plant breeding advances the improved strains are likely in appearance to be practically indistinguishable from the old. This is especially likely to be the case in regard to disease-resistant strains. In America the problem is likely to be solved by the Crop Improvement Societies, which have the great advantage of being local bodies ably supervised by the State Experiment Stations.

Good examples of disease-resistant strains already replacing older varieties are the Kanred wheat of Kansas, and Red Clover

* See Melchers, L. E., and Parker, J. H., "Rust Resistance in Winter Wheat Varieties": U.S. Dept. of Agric., Bull. No. 1046, 1922.

resistant to Anthracnose disease selected by Professor Essary of Knoxville, Tennessee.*

The great majority of improved strains now largely grown in the States have been bred by selection and pure lines, but one has only to see the various segregates now on trial at Cornell and elsewhere to realize that the researches of Dr. Love and others who are working on Mendelian lines are very shortly destined to exert a profound influence on crop yields of cereals throughout the States.

Similarly with forage and herbage plants, technique and methods are rapidly being developed which will place the breeding of these crops on an exact and scientific basis.

Timothy and alfalfa breeding is in process at many of the Stations both in the United States and in Canada, while at Macdonald College and elsewhere in Canada exact hybridization work under controlled conditions is being undertaken with alfalfa, red clover and other herbage plants. At Cornell and at Macdonald College vegetative reproduction is largely used as an aid to the breeding of perennial grasses. Thus Dr. Myers at Cornell isolates his plants of Timothy for pollinating purposes by building up large beds of his strains by vegetative means, and at flowering time separating the beds by canvas sides and backs. The canvases are supported from horizontal wires attached to stout supports and are about 6 ft. high.†

An ability to withstand the winter is very important in herbage plants for Canada and the Northern States: very striking results were seen at Macdonald College showing marked difference in winter hardiness as between different strains of Timothy and cocksfoot.

The distribution of improved herbage seeds and the maintenance of the purity of the strains is particularly difficult in the case of these plants, which so readily cross-fertilize.

In the case of Timothy the price obtainable for hay has tended to cause the growers of improved strains to sacrifice the seed crop for the more easily handled and marketed hay crop which has operated against the rapid replacement of inferior by improved strains, a difficulty which by proper organization will doubtless be overcome.

* Bain, S. M., and Essary, S. H., "Selection for Disease-Resistant Clover," Bull. No. 75, Agric. Expt. Station, Knoxville, Tennessee.

† This review of the work on herbage plants is very incomplete as unfortunately it was found impossible to visit either the Timothy Breeding Station of the Bureau of Plant Industry at Elyria or the North Dakota Station at Fargo as had been arranged.

The importance of purity of strain is fully realized in Canada, where exceptional facilities are afforded for growing improved strains of cross-fertilizing plants on farms miles from other farms growing the same species. Conversations with Canadian agriculturists suggest that it is likely that Alberta for instance has a great future for producing seed of pure strains. This fact, together with the well organized activities of the Canadian Seed Growers Association, is of great potential importance to American and European farmers alike. Canadian red clover seed, for example, is known to be of considerable value in Britain, but is often supplied by vendors in this country mixed as to strain or in blend with other red clovers.

The writer wishes to express his indebtedness to Dr. William A. Taylor, Chief of the Bureau of Plant Industry, to Drs. Carleton R. Ball and C. V. Piper, in charge of Cereal and Forage Crop Investigations at the Bureau, and to Drs. A. J. Pieters and Clyde W. Warburton respectively, of the Forage and Cereal Branches, for the trouble they took in arranging an itinerary of the Stations and for the help generously afforded in supplying information in respect of the organization and working of the Bureaux and Stations.

Thanks are also due to the investigators at the Stations and at the Bureau, too numerous to mention individually, who one and all were at such pains to be helpful, while the writer is equally indebted to Mr. G. H. Clark, Seed Commissioner, Ottawa, for his help and kindness during the period spent in Canada.

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METHODS OF COVERING GRASS AND CLOVER SEEDS.

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THE results of the investigations in the depth of sowing grass and clover seeds previously given in this *Journal** obviously only apply to the conditions under which the investigations were conducted, namely, under exact laboratory and garden conditions, where tilth, moisture and temperature were under control.

In order to supplement these general results with information of more practical value another series of investigations was

* April, 1922, and May, 1922.

undertaken in order to determine the best methods of covering certain grass and clover seeds under ordinary field conditions.

Only the farm implements which are commonly used for the purpose were experimented with; the grass and clover drill which has recently been introduced has not been tried, but the method of sowing in drills is receiving attention and the results will be published in due course.

The investigations consist of three separate experiments, two of which were carried out on the experimental grounds of the Plant Breeding Station, while the other was conducted at Blaentwrch, Carmarthenshire.

Experiment 1.—Sixty-four rod plots were sown on 17th to 20th of May, 1920, on Penglais Field (medium loam in good tilth) during unsettled weather which proved highly favourable to germination.

An attempt was made to regulate the depth to which the seeds were buried by covering with different hand implements, namely, with an iron hand rake, a Canadian scuffler, and beating the soil with a shovel. Sixteen plots were done by each method, while the remaining 16 plots were left uncovered.

The plots were sown at four different rates, namely, full, $\frac{3}{4}$, $\frac{1}{2}$ and $\frac{1}{4}$ seedings, with a simple mixture consisting of 1 oz. of Italian rye grass, $\frac{1}{2}$ oz. cocksfoot and $\frac{1}{2}$ oz. red clover per plot as a full seeding. Half the number of plots were sown under rape at the rate of 2 lb. per acre, while the other plots were sown without a nurse crop. The whole block was so arranged that each of the four methods of covering had the same number of plots that had been treated differently as regards seeding.

All the plots covered by means of the rake, hand-scuffler and shovel were rolled a few days after sowing, but none of the plots were rolled before sowing.

Depths to which the Seeds were Covered.—An approximate estimate of the depths to which the seeds were covered by the different implements was made during the covering operations.

Rake.—About one-third of the grass seeds were left on the surface and hardly any of these seeds were covered to a depth of more than $\frac{1}{4}$ in., the average depth being about $\frac{1}{8}$ in. The clover seeds were more completely covered, the average depth being from $\frac{1}{4}$ to $\frac{3}{8}$ in., while a few were left uncovered.

Hand Scuffler.—Covered both the grass and clover seed more thoroughly than the rake, the average depth being $\frac{1}{2}$ to $\frac{3}{4}$ in.

Shovel.—Well over 50 per cent. of the grass seeds were covered to an average depth of $\frac{1}{4}$ in., while nearly all the clover

seeds were buried to a depth of about $\frac{1}{4}$ in. This method was much more effective in covering the seeds than the ordinary roller.

Surface Sowings.—A few seeds were covered as a result of treading during sowing.

The Number of Established Plants.—The number of plants of the three species sown were counted separately during the last week in July by taking 20 readings per plot, systematically distributed, with a 6-in. mesh. Counts were made on eight plots of each method of covering; the average results of these counts are given in Table I.

TABLE I.—Average number of plants of Italian Rye Grass, Cocksfoot, and Red Clover per 5 sq. ft. on plots covered by different methods.

Method of covering.	Italian Rye Grass.	Cocksfoot.	Red Clover.
Not covered ...	86	76	31
Shovel ...	105	89	89
Hand Rake ...	100	74	65
Hand Scuffler ...	103	77	89

Italian Rye Grass.—As shown in Table I, the three methods of covering gave fairly similar results in spite of the fact that there was an appreciable difference in the number of seeds covered and in the depths at which the seeds were buried by the three implements, but the "not-covered" plots had from 14 to 18 per cent. fewer rye grass plants than the covered plots.

Cocksfoot.—Very similar takes were obtained from the "not-covered" plots and the plots covered by rake and hand scuffler, but the plots covered by means of a shovel and then rolled gave from 16 to 20 per cent. more plants than the other three methods.

These results seem to suggest that if the seeds are not covered, cocksfoot is able to establish itself more readily than Italian rye grass.

Red Clover.—Red clover was much more affected by the method of covering than the two grasses. The best results were obtained on the plots covered by shovel and hand scuffler. If the number of plants obtained on these plots be taken as 100, then the plots covered by hand rake gave 73, while the "not-covered" plots only gave about 35 red clover plants. That the depth at which the seeds were buried was not the main factor affecting the "take" of red clover in this experiment is clearly shown by the fact that the shovel and the hand scuffler, which covered the seeds to depths of about $\frac{1}{4}$ in. and

$\frac{1}{2}$ to $\frac{3}{4}$ in. respectively, gave better results than the rake, which buried the seeds to a depth of about $\frac{1}{2}$ to $\frac{3}{8}$ in. Since the "not covered" plots and the plots covered by rake, which had the greatest number of seeds exposed on the surface, gave the poorest results, it is evident that the "take" was mainly dependent on the degree of completeness with which the seeds had been covered.

Experiment 2.—This trial was conducted at Blaentwrch, Carmarthenshire, in 1920, on stiff clayey loam under barley. The soil was repeatedly harrowed and rolled after sowing the barley and was finally rolled before sowing the grass and clover seeds, but owing to the clayey nature of the soil, the tilth was rather poor, as the surface soil consisted in the main of small hard lumps ranging from $\frac{1}{4}$ to 1 in. diameter.

The following grasses and clovers were sown on the 15th of May on pure duplicated rod plots, at the following rates of seeding per acre :—perennial rye grass, 30 lb.; cocksfoot, 20 lb.; red clover, 20 lb.; and white clover, 10 lb.

Two plots of each species were covered by five different methods by means of various farm implements. These were :—

1. Roller.
2. Chain harrow followed by roller.
3. Chain harrow with spikes down followed by roller.
4. Light peg harrow followed by roller.
5. Plots not rolled before sowing or covered after sowing.

The Effect of the Different Methods of Covering on the "Take."—The number of plants was counted in October, 1920, by taking 10 representative readings per plot by means of a 6-in. mesh. The average results for the different methods, which are expressed in terms of the number of established plants per square foot, are shown in Table II :—

TABLE II.—Average number of plants per square foot with the different methods of covering.

Method of Covering.	Perennial Rye Grass.	Cocksfoot.	Red Clover.	White. Clover.
Not covered	62	68	36	7
Rolled once	58	75	41	16
Chain harrowed, spikes down and rolled	62	86	45	38
Chain harrowed and rolled	64	87	59	50
Peg harrowed and rolled	78	90	53	47

As will be seen from Table II, the "not covered" plots and the plots covered by rolling only, while giving moderately good "takes" of perennial rye grass and cocksfoot, gave very poor results for both clovers—particularly for white clover. Despite the fact that a comparatively large number of seeds found

their way down between the small lumps which formed the surface soil, it is evident that neither red nor white clover was sufficiently well covered on these plots. The method of covering with spikes down was a decided improvement on rolling alone, the improvement in "take" being most marked in the case of white clover.

The two implements which gave the best results were the chain harrow and the peg harrow. The chain harrow produced a slightly better "take" of clovers than the peg harrow, but on the other hand, the rye grass plots had 22 per cent. and the cocksfoot plots 3.5 per cent. more plants when covered by the peg harrow. The total number of plants of the four species was practically the same for both methods; the difference in favour of the peg harrow is consequently regarded as being too small to be of any significance.

Experiment 3.—This was carried out on the Station's experimental grounds in 1922. Although the experiment was entirely confined to red clover it was of a much more exhaustive nature than the two experiments already described.

The block on which it was conducted had carried an oat crop in 1921. The ground was ploughed twice during the autumn, and again in March, and subsequently harrowed to a very fine friable tilth. The soil was a light loam of rather a stony nature. Forty 1/100th-acre plots were sown on the 8th May with two strains of red clover:—English broad red and Montgomery red, on duplicated plots, at the uniform rate of three million viable seeds per acre which was equivalent to 17.8 lb. per acre of broad red (90 per cent. germination) and 12.3 lb. of Montgomery red (96 per cent. germination). They were covered by the ten methods tabulated below, and arranged in such a way that four plots consisting of the duplicates of the two strains were covered by each method.

The implements used for the different methods of covering were:—

<i>For final operation before sowing.</i>		<i>For covering after sowing.</i>		
1. Chain harrow ...	...	None ("not covered").		
2. Smooth roller ...	...	Smooth roller.		
3. Chain harrow ...	...	" "	
4. " " ...	...	Horse hay rake followed by smooth roller.		
5. " " ...	...	Cambridge roller	"	"
6. Cambridge roller	...	"	"	"
7. Smooth roller	Chain harrow	"	"
8. " "	Light peg harrow	"	"
9. Chain harrow	Chain harrow	"	"
10. " "	Light peg harrow	"	"

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The soil was in an excellent condition for sowing. The fairly heavy rains of the last week of April and the first four days of May had ensured that it contained an abundant supply of moisture for germination while the surface soil was dry and friable. With the exception of a short break of intermittent rain 8 days after sowing the weather was warm and dry from the 5th to the end of May.

The counts were made on the 30th and 31st of May in the usual manner by taking 20 representative readings per plot with a 6-in. mesh. The average results of the counts are summarized in Table III.

The number of dead seeds found on the surface were counted by the same method. These figures, which are also shown in Table III, are admittedly only approximately correct on account of the difficulty experienced in detecting the "surface" seeds which were very much discoloured. Most of these dead surface seeds had obviously germinated, but had died back after failing to take root.

TABLE III.—Showing the average number of Red Clover seedlings and dead surface seeds per square foot on plots covered by different methods.

		<i>Number per square foot.</i>			
<i>Method.</i>		<i>Seedlings.</i>	<i>Probable Error.</i>	<i>Dead surface seeds.</i>	
1.	...	15.9	... + 1.73	...	8.0
2.	...	17.7	... + 1.20	...	12.8
3.	...	28.0	... + 2.07	...	7.0
4.	...	37.9	... + 2.79	...	2.6
5.	...	40.2	... + 3.31	...	3.8
6.	...	40.2	... + 3.35	...	6.1
7.	...	45.7	... + 2.19	...	3.2
8.	...	49.6	... + 2.04	...	2.4
9.	...	45.1	... + 3.14	...	1.6
10.	...	44.5	... + 1.42	...	2.0

Loss and Waste of Seed.—It is not generally realised that the usual method of sowing small seeds broadcast is exceedingly wasteful, and that a large amount of seed is lost even when the most efficient method of covering is employed. For instance, only 44 to 49 seedlings per square foot were counted on the plots covered by peg and chain harrows, although the plots had been sown at the rate of 69 viable seeds per square foot, that is, 28 to 36 per cent. of the germinable seeds sown failed to become established. In other words, as much as $4\frac{1}{2}$ lb. to $6\frac{1}{2}$ lb. per acre of pure viable seeds of the broad red clover, sown at the rate of 15.8 lb. per acre, were lost. With the seed of broad red clover at 2s. per lb. this entails a cash loss of 9s. to 13s. per acre.

The Chief Cause of Failures in "Take."—A glance at Table III will show that there is a very definite correlation between the number of established seedlings and the number of dead seeds found on plots covered by different methods, and that on the average the best results were given by methods which left the fewest seeds uncovered. This was fully borne out by observations made on the plots during the covering operations. It is thus evident that the "take" was not seriously affected by the depth to which the seeds were covered (within the range of depth effected by the various methods employed); it seems to depend almost entirely on the degree of thoroughness with which the seeds were covered.

The failure of uncovered red clover seeds to become established is due to the inability of the radicles to enter the soil in the absence of a thin covering of soil which holds the seeds in position until the radicles are fixed.*

Soil and Weather Conditions affecting Covering.—*Soil.*—While making the counts on No. 3 experiment it was observed that the seedlings were almost invariably thicker on the portions of the plots where the surface soil consisted mainly of small lumps ranging from $\frac{1}{4}$ to $\frac{3}{4}$ in. in diameter, than on areas on which the surface soil had been reduced to a very fine state of tilth.

The superior "take" obtained on the fairly coarse soil as compared with that found on very fine soil is easily explained by the fact that the small loosely packed lumps of the coarse soil offered less resistance to seed penetration than the close packed minute particles of the finer soil. The seeds were therefore much more thoroughly covered on the coarser areas.

Weather.—With a view to determining the effect of the weather conditions prevailing at the time of sowing on the resultant "take" of red clover, counts were made on a number of plots of two red clover nationality trials laid down at the Plant Breeding Station in 1922. The results obtained are compared with those given by the plots which had been similarly covered in No. 3 experiment.

The No. 3 experiment and the two trials referred to were all sown on light loam but in different fields. All the plots were sown at the same rate, namely, three million viable seeds per acre, and were similarly covered by means of a horse rake and rolled. The tilth of the three trial blocks was excellent. As previously stated, No. 3 experiment was sown on the 8th May.

* See Depth of Sowing: *this Journal*, April, 1922.

when the surface soil was perfectly dry, consequently the seeds on the raked plots were fairly well covered.

One of the nationality trials (Trial A), which consisted of 84 one-hundredth-acre plots, was sown on 23rd May, under what was regarded at the time as ideal weather conditions for sowing small seeds, namely, during a spell of showery weather and when the surface soil was decidedly damp. The seeds were very poorly covered as they clung to the wet surface soil instead of dropping through between the particles as they do normally when the soil is dry. It rained fairly heavily on the night 23rd/24th May but on 25th the weather changed to a dry period which lasted over three weeks. The seeds germinated exceedingly well within 3 to 5 days of sowing, but it was observed that practically all the surface seeds failed to take root. As a result all the plots gave very poor "takes," although the ground which had not been ploughed since December, 1921, contained an abundant supply of water which proved quite sufficient to maintain the seedlings that had taken root in a healthy growing condition throughout the period of the drought.

The other Trial (B), which involved 168 one-hundredth-acre plots, was sown on the 29th May under totally different conditions from Trial (A). The ground was ploughed twice, as late as April and May, and was so thoroughly worked during the dry weather of May that the top 3 to 4 in. of soil was practically dry when sown. The seeds were therefore exceedingly well covered.

Sowing took place during a long drought which, to all intents and purposes, lasted for 24 days after the sowing, although a little rain was recorded 16 days after sowing. The seeds remained in the ground for nearly four weeks without showing any signs of germinating, but they soon germinated after the heavy showers of 22nd and 23rd June and gave surprisingly thick and uniform "takes" on all the plots.

Four plots sown with the same lots of English broad red and Montgomery red clovers were counted in the usual way by taking 20 readings per plot in each of the three trials.

The average results are given below:—

<i>Trial.</i>	<i>Condition of soil at time of sowing.</i>	<i>Date of sowing.</i>	<i>No. of seedling per sq. foot.</i>
No. 3 Experiment ...	Surface soil—dry ...	7th May ...	37.9 ± 2.79
A ...	Surface soil—decidedly damp ...	23rd May ...	23.8 ± 0.10
B ...	Surface soil—particularly dry ...	29th May ...	43.0 ± 1.26

These results show that the raked plots of No. 3 experiments and the Trial B plots gave respectively 57.9 per cent. and 80.7 per cent. more seedlings than the counted plots of Trial A. These results fully confirm the observations made on the relative "takes" obtained in the different trials.

It is thus evident that satisfactory "takes" cannot be obtained if the seeds are sown broadcast when the surface soil is wet, and that excellent results will be obtained if the seeds are sown during a long period of drought provided (1) the soil is sufficiently dry to delay germination until the drought breaks, and (2) that the seeds are properly covered at the time of sowing.

SUMMARY.—The evidence discussed in this paper is summarized below. It should be emphasised, however, that the conclusions reached apply only to the species tested, namely, Italian rye grass, perennial rye grass, cocksfoot, red clover and white clover, and do not necessarily apply to other varieties of grasses and clovers.

1. Not one of the implements under investigation for covering grass and clover seeds buried the seeds too deeply. Hardly any of the seeds were covered to a depth of more than $\frac{1}{2}$ in., even by the peg-harrow.

2. Good "takes" of red clover and white clover, and to a less extent of Italian rye grass, perennial rye grass and cocksfoot, depended more on the degree of thoroughness with which the seeds were covered than on any other factor usually operative when sowing small seeds.

3. The implements which gave the best covering invariably gave the best results.

4. The most effective implements for covering the grass and clover seeds investigated, on all the types of soils experimented upon, were the peg-harrow and chain-harrow.

5. The "not-covered" sowing and plots covered by a smooth roller gave fairly good results for the grass seeds, but very poor "takes" for clover seeds.

6. The horse-hay-rake and the Cambridge roller were not so effective in covering red clover seeds as the two kinds of harrows, except, possibly, under certain conditions, but they are superior to the harrows for covering trial plots. The chain-harrow, however, is a particularly unsuitable implement for this purpose as it is very apt to drag seeds from plot to plot.

7. A very fine powdery surface gave a poorer "take" than a slightly rough surface which consisted of small lumps ranging from $\frac{1}{4}$ to $\frac{3}{4}$ in. in diameter.

8. Poor "takes" of red clover were obtained from plots sown when the surface soil was wet, on account of the fact that the seeds which clung to the wet soil could not be properly covered.

9. Excellent results were obtained by sowing red clover on a very dry soil during a long period of drought which delayed germination for nearly a month.

10. There was an enormous loss of viable red clover seeds amounting to about 4 to 7 lb. per acre, even when the seeds were covered by the most effective implements.

11. It would seem from the results obtained that it is of the utmost importance to cover the seed properly; consequently, it would appear reasonably certain that very considerable economy could be effected, at all events in the use of the grass and clover seeds under review, if they could be sown with a special drill made for that particular purpose.

Grateful acknowledgment is made to Messrs. Sutton & Sons, of Reading, who kindly supplied the seed ready weighed and mixed for the numerous plots in connection with Experiment No. 1. Thanks are also due to Mr. A. D. Thomas, B.Sc., now Agricultural Organiser for Carmarthenshire, who assisted with the analysis made relative to Experiment No. 1.

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TRIALS OF POTATOES FOR IMMUNITY FROM WART DISEASE, 1922.

THE trials which are conducted by the Ministry each year with the object of testing new varieties of potatoes for immunity from wart disease were again carried out during 1922 on the farm of the National Institute of Agricultural Botany at Ormskirk. The actual field operations, and the taking of records, were carried out by Mr. H. Bryan, B.Sc., and Miss Whitehead of the Institute, but the trials were conducted on a plan approved by the Ministry.

The Ministry has accepted the findings of the Potato Synonym Committee set up by the Institute, and has classed varieties as synonymous with existing varieties where recommendations to that effect were made by the Synonym Committee.

After full consideration of the results of the trials, the following varieties have been added to the list of those approved as immune from wart disease :—

Millar's Beauty	Utility
Marquis of Bute	Golden Las
Ben Lomond	International Kidney
Ben Ledi	Clifden Seedling
Ben Cruachan	

In the report on the 1921 trials (see this *Journal*, March, 1922, p. 1147), it was stated that, except in one or two instances, the Ministry was unable to approve as immune from wart disease certain varieties which had successfully passed their second year's test, on the ground that because of the abnormal weather conditions, no dependable interpretation of the results could be made. Because of this decision it was necessary to grow at Ormskirk some 17 kinds for a third year's test. One of these 17 varieties—Ben Wyvis—succumbed to wart disease, but the others remained immune. This extra year's test, while it may have caused inconvenience to potato breeders, has, nevertheless, been the means of preventing an error and of maintaining the high reputation for accuracy which the Ormskirk trials must aim at.

Two of the varieties (Ben Nevis and Ben More) proved to be synonymous with existing kinds: one stock was badly mixed (Ben Doarg); in the case of three lots the growth was so poor that the Ministry cannot take them into consideration; and four are unnamed seedlings which may be listed as soon as the raisers have given them names. The remaining six varieties have been approved as immune varieties, and are included in the list above.

Ninety-one lots of potatoes on which no wart disease had appeared during the season of 1921 were included in the second year's trials, and, for the reasons stated above, it is not surprising to learn that in no fewer than 24 cases wart disease appeared amongst the crops in 1922. The freedom from wart disease of four others, Titan, Belle de Fontenay, Ben Braggie, and Ursus, is doubtful. Two lots were different from the variety tested under the same name in the previous year and were discarded. Eleven of the others proved to be synonymous with existing varieties in commerce, viz., Ben Avon, Ben Ratha, 8 historical varieties and one seedling, whilst one seedling was entered under two different numbers. In four instances (Quarantaine de la Halle, Colonist and two seedlings) the growth of the crop was unsatisfactory, and although no wart disease appeared no decision as to immunity could be made. In the remaining 45 cases the varieties were distinct and free from disease. These comprised twelve seedlings (No. 1. BL., No. 12, No. 17, 461/16, No. 301, No. 310x, No. 365, Seedling C.1. and four others), and the following varieties :—Utility, Wild Rose, Macduff Seedling, The Massie, Glenalmond,

Merville D'Amerique, Ceres, Benalt, Ben Alton, Ben Hope, Ben Doirean, Ben Tee, Ben M'hor, Ben Staroa, Ben Vane, Ben Fin, Ben Tallach, Ben Bhan, Ben Alder, Ben Choire, Ben Fhada, Ben Mere, Ben Hutick, Ben Clench, Ben Ime, Ben Sriel, Ben Eay, Destiny, Snowflakes, Brown Rocks, Red Kemps, Brown Blacks, Peps.

The rainfall during the early months of the test was below the average, the deficiency being 0.26 in. in April, 0.43 in. in May, and 0.13 in. in June, but above the average by 1.85 in. for the month of July, and 2.47 in. for August, so that the soil moisture was sufficient to allow the fungus full development. The temperature, however, was low, and the activity of the fungus was thus apparently hindered, for the losses of crop were less severe than was expected. Nevertheless, the test for immunity was a severe one, though not sufficiently rigorous completely to counterbalance the lack of dependence which can be placed on the tests to which the potatoes were submitted during 1921. It has, therefore, been decided that varieties in the last-mentioned group should not be approved as immune unless there are special reasons for such a decision. For most of these varieties there are no special reasons, and they will need to be re-tested in 1923. There is, however, sufficient evidence of the immunity of "Utility," and this variety has been approved.

Moreover, the variety previously known as Seedling 449 (a) (1), declared in 1920 to be immune, has now been put on the market under the name "Golden Las." It was again tested at Ormskirk, last year, and found to be free from wart disease, and has, therefore, been added to the approved list, together with the well known International Kidney and Clifden Seedling.

One hundred and thirty-four plots of potatoes were planted in the trials with varieties which had not hitherto been tested; of these 40 proved synonymous with existing kinds, and 40 proved susceptible.

Trials of seedlings, which are also made, are quite separate from the immunity tests proper. From 5 to 10 tubers only are planted, and the trials are carried out merely for the purpose of providing raisers with facilities for finding out quickly which of the seedlings are susceptible. Firms and private persons took advantage of this facility, together with the John Innes Research Station; the School of Agriculture, Cambridge; the Irish Department of Agriculture, and the Education Department, Lancashire County Council.

New Approved Immune Varieties.—The following are the descriptions of those varieties of potatoes which have been added to the Ministry's list of varieties approved as immune to Wart Disease in consequence of the 1922 trials. Descriptive lists of the varieties approved in previous years are obtainable free and post free on application to the Ministry.

Second Early Varieties:—

Ben Lomond.

Tubers - pebble; skin white; eyes shallow; flesh white tinged lemon; sprout purple.

Haulm - bushy, upright; internodes short, weak, bronzed, knife-edged; leaflets medium size, medium green, slight bronzing in axil, drooping, corrugated.

Flowers - white.

International Kidney.

Tubers - long kidney, flat; skin white; eyes shallow; flesh white; sprout mauve.

Haulm - upright, medium; stems not branched; internodes medium, weak, mottled purple; leaflets medium to small, rolled, folded, dark green, shiny, terminal leaflets frequently fused.

Flowers - none observed, buds dropping.

Marquis of Bute.

Tubers - round; white skin; eyes pink, deep; flesh white; sprout pink.

Haulm - upright, somewhat resembling Nithsdale; leaflets broad and glossy.

Flowers - white, few.

Late or Maincrop Varieties:—*Ben Cruachan.*

Tubers - round to pebble; skin white; eyes shallow; flesh pale lemon; sprout purple.

Haulm - regular, tall, upright; internodes short, bronzed, knife-edged; leaflets corrugated, dull, small, narrow, yellowish-green.

Flowers - white, few, buds dropping.

Ben Ledi.

Tubers - round, flat; skin white; eyes medium; flesh white; sprout rose.

Haulm - regular, upright, erect; internodes short, stout, bronzing in axil; habit of growth somewhat resembling Tenipar; leaflets medium green, leathery appearance, upright, pointed; leaf closed.

Flowers - white.

Clifden Seedling.

Tubers - round; skin white; eyes medium; flesh white tinged lemon; sprout rose.

Haulm - regular, upright; internodes short, stout, much gophered, slightly bronzed; leaflets medium size, slightly corrugated, upright, dark green.

Flowers - white, large, numerous.

Golden Las.

Tubers - oval, flat; skin white; eyes shallow; flesh yellow; sprout apparently colourless.

Haulm - erect, bushy; stems light green; internodes thin, short; leaflets dull greyish-green.

Flowers - white.

Millar's Beauty.

Tubers - kidney; skin white; eyes shallow; flesh pale lemon; sprout pink.

Haulm - upright; leaflets medium green, medium size, corrugated; leaf open.

Flowers - none observed, buds dropping.

Peerless.

Tubers - round; skin reddish purple; eyes shallow; flesh white; sprout deep purple.

Haulm - regular, upright; much bronzing of stem and mid-rib; leaflets small, corrugated.

Flowers - white, large, numerous.

Utility.

Tubers - round; skin flushed pink; eyes shallow; flesh white; sprout deep rose.

Haulm - regular, vigorous; stem bronzed, serrated; leaflets medium size, corrugated, dull dark green; leaf open.

Flowers - none observed, buds dropping.

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NOTES ON MANURES FOR MARCH.

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The Prevalence of Acid Soils.—It is necessary to draw attention to the prevalence of acid soils in the country because no treatment short of liming will enable the farmer to make the best use of them on any ordinary system of farming.

Some time ago the Rothamsted Experimental Station invited agriculturists and expert advisers to send in particulars of infertile soils where the infertility did not appear to be due to any ordinary or known cause. In practically all instances so far referred to us investigation has shown that the trouble is due to acidity, which in some cases has become very pronounced. The symptoms are not always clearly recognised, but there are certain well defined characteristics which every farmer should know and be able to observe without difficulty.

In the first case the crop on acid soils is almost invariably patchy; there are streaks of badness or patchiness where the crop is poor or fails altogether, and no amount of manuring helps matters. In some seasons the harmful effects hardly show; in others they are more pronounced.

On grassland the patches are often very dark green in colour, the herbage is not good and there is no clover. Here recognition of the cause is not usually difficult, and most farmers can tell when grassland is suffering from sourness.

With arable crops, however, the case is different; certain of the features are not so generally recognised to be symptoms of sourness. Usually root development is poor, the leaves are yellowish, and from the outset the plants never flourish, although they may not actually die. The appearance is not unlike that of plants on water-logged soil, but the trouble occurs on land which is well-drained and it also appears in dry seasons.

An excellent illustration was afforded on a farm which the writer had occasion to visit last October, where the field was reported to be infertile in places though the remaining part was quite good. The soil is a medium loam on the ironstone sand, and the crop was mangolds. The appearance of the plants on the bad patches suggested direct poisoning; the plants were small and had never grown, although on the surrounding land some immense roots were seen. The leaves were yellowish and had at no time acquired a healthy green colour; they also remained small. The root development was very stunted and gave the impression of root asphyxiation, as if the ground had lain wet; but the farmer was quite clear that the land was not waterlogged even in wet weather. It was difficult to say which was the more remarkable phenomenon: the striking contrast between the good and the bad plants, or the fact that such sickly-looking plants could have survived to the end of the season without appreciable growth and apparently neither living nor dying.

The possibility that the bad effects were due to waterlogging was further ruled out by the circumstances that they had been just as marked, and the appearance was much the same, for the wheat crop on the field in the very dry season of 1921 as for mangolds in the wetter season of 1922. Potatoes had also been affected.

Examination of the soil showed the patches to be extremely acid. The method now in use at Rothamsted allows a much better measurement of acidity than was previously possible, and enables us to place soils in their position in a fertility scale. Tested by this method the bad patches were found to be near the limit where sterility is reached, and even the good soil had no great margin of safety. The recommendation given to the farmer was to lay out three strips across the field receiving respectively $2\frac{1}{2}$, 5 and 10 tons of powdered carbonate of lime per acre; after seeing the results for one season it will be possible to decide on the most suitable dressing for the whole field. It would of course be possible to recommend at once a dressing sufficient to remove all acidity, but this might be more than is immediately necessary and no farmer at the present time wishes to spend more on his land than can be helped.

Another instance was brought to our notice almost at the same time. The crop was white turnips and it failed in patches. In this case a clue was given in that spurrey grew abundantly. Examination showed that the soil was acid almost to the limit

of sterility, and the same recommendation was made as in the preceding case.

These two soils both came from the eastern part of England. Our observations in the West Country show that the need for lime is there very great, and farmers' clubs would be well advised to go into the matter and see if there is any possibility of arranging for the work to be done on some co-operative or other basis that would eliminate all unnecessary expenditure.

Nitrogenous Top-Dressings for Cereal Crops: some Results of last Season.—The results of last season's experiments are now coming in, and they afford striking illustrations of the value of nitrogenous dressings for cereal crops. Among those already to hand are the following:—

Herts, Rothamsted—Wheat :

<i>Per acre.</i>	<i>Grain, bush. per ac.</i>	<i>Straw, cwt. per ac.</i>
1 cwt. sulphate of ammonia	22.5 ...	23.8
No nitrogen	14.2 ...	18.0
	8.3 ...	5.8

Devon—Wheat :

<i>Per acre.</i>	<i>Grain, bush. per ac.</i>	<i>Straw, cwt. per ac.</i>
1 cwt. sulphate of ammonia and 5 cwt. basic slag	38.9 ...	20.9
No nitrogen, but 5 cwt. basic slag ...	29.6 ...	13.9
	9.3 ...	7.0

Gains of $8\frac{1}{2}$ and $9\frac{1}{2}$ bushels of wheat grain respectively, and 6 and 7 cwt. of straw respectively were obtained from the use of 1 cwt. of sulphate of ammonia. There could be no doubt that nitrate of soda would have acted at least as well.

Cumberland—Oats :

<i>Per acre.</i>	<i>Grain, bush. per ac.</i>	<i>Straw, cwt. per ac.</i>
1 cwt. sulphate of ammonia	63.75 ...	47.25
No nitrogen	55.5 ...	44.25
	8.25 ...	3.0

Gains of $8\frac{1}{2}$ bushels of oats and 3 cwt. of straw were obtained from 1 cwt. of sulphate of ammonia: and again it is practically certain that as good a result could be obtained with nitrate of soda.

Instances could be multiplied where top dressings of nitrogenous fertilisers have proved advantageous to cereal crops.

Manurial Dressings for Barley.—A number of experiments were carried out at different centres last year to test a scheme organised by the Rothamsted Experimental Station in conjunction with the Institute of Brewing. The results are being worked

out, but already at a number of centres it is being found that a complete dressing of artificial manures increases the yield and usually improves, but never depresses the quality. Among some of the results already worked out are:—

	Louth.	Walcott.
	<i>Lines.</i>	<i>Lines. Rothamsted.</i>
Complete artificials	30.9 ...	60.3 ... 32.6
No manure	25.2 ...	56.9 ... 25.8
Gain, bush. of barley	5.7 ...	3.4 ... 6.8

The 3.4 bushel gain at Walcott, however, was insufficient to pay for the manure, it being difficult to increase a yield which is already nearly 57 bushels by any profitable means.

Prices of Artificial Manures.

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

DESCRIPTION	Price per ton					Cost per Unit at London
	Bristol	Hull	Lpool	Luton		
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	
Nitrate of Soda (N. 15½ per cent.)	14.10	13.17	13.10	13.15	17.9	
" " Lime (N. 13 per cent.) ... ..	...	...	...	12.2	18.8	
Sulphate of Ammonia, ordinary (A. 25¼ per cent.)	15.15*	15.15*	15.15*	15.15*	(N)15.2	
" " " neutral (A. 25¼ per cent.)	16.18*	16.18*	16.18*	16.18*	(N)15.11	
Kainit (Pot. 12½ per cent.) ... ..	...	...	...	4.17	3.0	
French Kainit (Pot. 14 per cent.)	2.5	2.1	...	2.2	3.0	
Sylvinit (Pot. 20 per cent.) ... ..	...	...	...	3.0	3.0	
Potash Salts (Pot. 30 per cent.) ... ..	...	...	...	4.5	2.10	
Muriate of Potash (Pot. 50 per cent.) ... ..	...	8.15	8.10	8.15	3.7	
Sulphate of Potash (Pot. 48 per cent.) ... ..	...	12.15†	12.0	12.0	5.0	
Basic Slag (T.P. 30-32 per cent.)	3.15§	...	...	3.17§	2.6	
" " (T.P. 24-26 per cent.) ... ..	...	2.13§	2.12§	...	...
" " (T.P. 20-22 per cent.)	2.12§	2.5§	...	2.13§	2.7	
" " (T.P. 16-18 per cent.)	2.2§	...	2.5§	2.11§	3.0	
Slag Phosphate (T.P. 60 per cent.)	6.7§	...	...	6.15§	2.3	
" " (T.P. 50 per cent.) ... ..	...	...	...	5.15§	2.4	
" " (T.P. 40 per cent.)	4.7§	...	...	...	...
Superphosphate (S.P. 35 per cent.)	1.2	...	4.0§	3.15	2.2	
" " (S.P. 30 per cent.)	3.12	3.2	3.10§	3.7	2.3	
Bone Meal (T.P. 45 per cent.)	9.10	9.10†	9.0	9.0	...	
Steamed Bone Flour (T.P. 60 per cent.)	8.10†	7.10†	8.0	7.0	...	
Fish Guano (A. 9-10, T.P. 16-20 per cent.)	12.15	...	12.5	12.15	...	

Abbreviations: N.=Nitrogen; A.=Ammonia; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

* Delivered in 4-ton lots at purchaser's nearest railway station.

† Delivered (within a limited area) at purchaser's nearest railway station.

‡ At Goole.

§ Prices include cost of carriage from works to town named. Cost to purchasers in other districts will be greater or less according to the distance of different purchasers from the works.

NOTES ON FEEDING STUFFS FOR MARCH.

E. T. HALNAN, M.A., Dip. Agric. (Cantab.),
Ministry of Agriculture and Fisheries.

The Effect of Feeding Stuff on the Quality of Bacon.—In the feeding of pigs for bacon production, there are several factors to be taken into account if it is desired to produce bacon of good quality. According to the extensive studies of Danish and Canadian investigators, it would appear that the production of poor quality bacon is due to the following factors, namely, improper feeding, unthriftiness, lack of exercise, immaturity and lack of finish.

The three chief fats present in the pig are olein, palmitin and stearin. Olein is liquid at ordinary temperatures, while the other two are solid. Shutt, of the Ottawa Experimental Station, came to the conclusion that soft, oily bacon is caused by the presence of too large a proportion of olein in the fat. It has also been shown that pigs finished under sty conditions in a warm atmosphere produce a much firmer bacon than those fed under cold, draughty conditions.

The chief contributory cause to the production of soft, oily bacon of low quality is, however, the use of unsuitable feeding stuffs and unsuitable mixtures of feeding stuffs. As a general rule, feeding stuffs rich in oil give a bacon of poor quality, while feeding stuffs rich in carbohydrates and poor in oil give a good quality bacon. It is stated that linseed cake, rich in oil gives a soft, oily carcass, whereas linseed meal from which the oil has been extracted, gives a good carcass with white, solid fat.

It becomes very important, therefore, for all pig feeders producing pigs for bacon, to study carefully the mixture given to their pigs, particularly in the later stages of fattening. Unless a dry-feeding system is adopted the amount of water in the slop given should be gradually reduced, and in the last month of fattening the slop should be of the consistency of thick porridge. Maize meal is notoriously unsuitable for bacon, and should not form a very large proportion of the meals used in the finishing period. A pig finished largely on maize meal gives an oily, yellow carcass, and most oil cakes and oil meals, particularly earthen meal and soy bean meal, give a soft, oily

1923.]

NOTES ON FEEDING STUFFS FOR MARCH.

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DESCRIPTION.	Price per Qr.		Price per		Manurial Value per Ton.	Cost of Food Value per Ton.		Starch Equiv. per 100 lb.	Price per Unit, Starch Equiv.		Price per lb. Starch Equiv.
	s.	lb.	Cwt.	£ s.		£ s.	£ s.		s.	d.	
Wheat, British	43/-	504	9/7	9 12	0 18	8 14	71 6	2/5			1.29
Barley, British Feeding	28/9	400	8/1	8 2	0 14	7 8	71 2/1				1.12
" Danubian "	31/6	400	8/10	8 17	0 14	8 3	71 2/4				1.25
" Persian "	28/9	400	8/1	8 2	0 14	7 8	71 2/1				1.12
Oats, English White	30/-	336	10/-	10 0	0 16	9 1	59 5	3/1			1.65
" Black & Grey	27/6	336	9/2	9 3	0 15	8 7	59 5	2/10			1.52
" Scotch White	36/-	336	12/-	12 0	0 16	11 4	59 5	3/9			2.01
" Canadian No. 2											
Western	30/3	320	10/7	10 12	0 16	9 16	59 5	3/4			1.78
" No. 3	28/9	320	10/1	10 2	0 16	9 6	59 5	3/2			1.70
" Feed "	27/9	320	9/9	9 15	0 16	8 19	59 5	3/-			1.61
" American	26/-	320	9/1	9 2	0 16	8 6	59 5	2/9			1.47
" Argentine	26/-	320	9/1	9 2	0 16	8 6	59 5	2/9			1.47
Maize, Argentine	37/6	480	8/9	8 15	0 15	8 0	81	2/-			1.07
" American	37/-	480	8/8	8 13	0 15	7 18	81	1/11			1.03
Beans, English Winter	50/-	532	10/6	10 10	1 17	8 13	67	2/7			1.38
" Rangoon			8/9	8 15	1 17	6 18	87	2/1			1.12
Peas, English, Dun	60/-	504	13/1	13 7	1 13	11 14	69	3/5			1.83
" Maple	92/-	504	20/5	20 8	1 13	18 15	69	5/5			2.90
Millers' offals—											
Bran, British				7 10	1 11	5 19	45	2/8			1.43
" Broad				8 10	1 11	6 19	45	3/1			1.65
Fine middlings (Im- ported)				9 0	1 5	7 15	72	2/2			1.16
Coarse middlings (British)				7 12	1 5	6 7	64	2/-			1.07
Pollards (Imported)				6 17	1 11	5 6	60	1/9			0.94
Barley Meal				10 5	0 14	9 11	71	2/8			1.43
Maize				10 5	0 15	9 10	81	2/4			1.25
" Germ Meal				9 15	1 2	8 13	85 3	2/0			1.07
" Gluten-feed				9 5	1 12	7 13	75 6	1/10			0.98
Locust Bean Meal				8 2	0 11	7 11	71 4	2/1			1.12
Bean Meal				12 12	1 17	10 15	67	3/3			1.74
Fish				15 15	4 19	10 16	53	4/1			2.19
Linseed				20 15	1 16	18 19	119	3/2			1.70
" Cake, English, (9% oil)				13 17	2 4	13 13	74	3/2			1.70
Soya Bean Cake (6% oil)				12 5	3 2	9 3	69 1	2/8			1.43
Cottonseed, English (5% oil)				8 0	2 0	6 0	42	2/10			1.52
" " Egyptian (5% oil)				7 17	2 0	5 17	42	2/9			1.47
Coconut Cake (6% oil)				9 2	1 15	7 7	73	2/-			1.07
Decorticated Ground- nut Cake (9% oil)				13 5	3 4	10 1	73	1/8			0.89
Palm Kernel Meal (2% ")				6 7	1 8	4 19	71 3	1/4			0.71
Feeding Treacle				4 7	0 9	3 18	51	1/6			0.80
Brewers' grains, dried, ale				7 15	1 8	6 7	49	2/7			1.38
" " porter				7 5	1 8	5 17	49	2/5			1.29
" " wet, ale				1 7	0 11	0 16	15	1/1			0.58
" " wet, porter				1 2	0 11	0 11	15	-/9			0.40

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of January and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose coconut cake is offered locally at £10 per ton. Its manurial value is £115s. per ton. The food value per ton is therefore £8 5s. per ton. Dividing this figure by 73, the starch equivalent of coconut cake as given in the table, the cost per unit of starch equivalent is 2s. 3d. Dividing this again by 224, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices:—N, 15s. 2d.; P₂O₅, 4s. 7d.; K₂O, 2s. 10d.

carcass. Beans are also said to be unsuitable for bacon production, but the available evidence is not very clear on this point. Barley meal, separated milk, whey, pea meal, wheat middlings and crushed oats are all suitable for bacon production and give a good quality carcass. Potatoes and most root crops are suitable foods for pigs intended for bacon. Of the oilcakes, palm kernel and coconut cakes are suitable for inclusion in the finishing period.

Cakes and meals that have been found suitable for the production of mutton and beef are not suitable for producing good quality bacon. The pig naturally tends to produce a soft fat, whereas sheep and bullocks tend to produce a hard fat. Cakes and meals are fed to sheep and bullocks for the purpose of softening the fat, and it is obvious, therefore, that if the same cakes and meals are given to pigs a soft, oily carcass will result. In feeding pigs for bacon, breeders should endeavour to check the suitability of the mixtures fed by obtaining from the factory a report on the quality of the carcass.

FEEDING STUFFS.	Value per Ton on Farm.	Manurial Value per Ton.	Food Value per Ton.	Starch Equivalent per 100 lb.	Value per unit S.E.	Market Value per lb. S.E.
	£ s.	£ s.	£ s.		s. d.	d.
Wheat	8 1	0 18	7 3	71.6	2/0	1.07
Oats	6 15	0 16	5 19	59.5	2/0	1.07
Barley	7 16	0 14	7 2	71.0	2/0	1.07
Potatoes	2 0	0 4	1 16	18.9	2/0	1.07
Swedes	0 17	0 3	0 14	7.0	2/0	1.07
Mangolds	0 15	0 3	0 12	6.0	2/0	1.07
Good Meadow Hay	4 16	0 16	4 0	31.0	2/7	1.38
Good Oat Straw	2 12	0 8	2 4	17.0	2/7	1.38
Good Clover Hay	5 6	1 3	4 3	32.0	2/7	1.38
Vetch and Oat Silage	2 0	0 8	1 12	14.0	2/3	1.22

A CASE of considerable interest to poultry keepers was recently heard at Nottingham. In this instance, the Local

Authority of Nottingham proceeded under the Merchandise Marks Act, 1887, on behalf of the Ministry of Agriculture, against a firm who had applied the description "Sussex Ground Oats" to an article which consisted of a mixture of 80 per cent. of ground oats and 20 per cent of barley. The idea has been current for many years that the addition of barley was necessary to facilitate the grinding of

oats to the degree of fineness required in the case of Sussex ground oats, and it has even been alleged that any purchaser of Sussex ground oats would expect to get a proportion of barley in the oats. The Ministry, however, called in evidence some of the principal millers of Sussex ground oats, who proved that the addition of barley is not necessary and that the practice is not adopted by firms of repute. This was confirmed by the evidence of the Government Analyst, who stated that a considerable proportion of a number of samples of ground oats submitted to him were commercially pure. A point raised by the defence was that at the time the sample in question was manufactured, barley and oats were about the same in price, but the evidence for the prosecution showed that barley costs £1 per ton less to grind than oats, so that even when barley and oats are the same price, there is still an inducement to add barley meals. It was, moreover, pointed out that low grade barley, which makes a good meal, can often be bought at a very low price.

A fine of £10 and £15 costs was imposed. It is hoped that the result of these proceedings will tend to check the adulteration of Sussex ground oats, which has been unfortunately common for many years past. Poultry keepers who desire to use a mixture of ground oats and barley should purchase the articles separately and mix them for themselves.

* * * * *

ARRANGEMENTS have been made with the authorities of the Midland Agricultural College, to hold a course of instruction in Milk Recording, from 30th April to 19th May, 1923, provided that a sufficient number of students apply for admission.

**College Course in
Milk Recording.**

A syllabus showing full particulars of the course may be obtained on application to the Principal, Midland Agricultural College, Sutton Bonington, Loughborough. The course includes lectures on milk—its nature and composition—bacteria and their relation to milk, testing of milk, and the principles and practice of milk recording; and practical work on actual milk recording of a comprehensive character, including food records, cost of foods, and cost of food per gallon of milk. The tuition fee will be £8. Board may be obtained at the Sutton Bonington Hostel (30s. per week), or at the Kingston Hostel (27s. per week).

Preference will be given to students who are either already milk recorders under the Ministry's scheme or who intend to apply for such posts. It is not possible to give any indication as to what vacancies for milk recorders may arise, nor can any guarantee be given that students will in fact obtain employment as milk recorders. The names of successful students will, however, be circulated by the Ministry to all milk recording societies in order that preference may be given by societies to these students on the occasion of filling a vacancy. The appointments carry salaries ranging usually from £150 to £250 per annum, and they afford to young agriculturists a unique opportunity of acquiring a practical knowledge of dairy farming, often of the best type, as carried out on a variety of farms.

* * * * *

FROM 1st November, 1921, to 4th September, 1922, the National Utility Poultry Society, in conjunction with the Great

**The National
Utility Poultry
Society's Egg-
Laying Test,
1921-22.**

Eastern Railway Co., carried out the fifth of its series of egg-laying tests on the Company's farm at Bentley, Suffolk. This was the second test in which the co-operation of the Utility Duck Club was secured in promoting a section for the testing of ducks. The number of pens entered was 368, consisting of 1,540 pullets and 265 ducks, a record for trials in this country.

The number of Sections was increased to nine, viz.:—(1) White Leghorns, (2) White Wyandottes, (3) Rhode Island Reds, (4) Sussex (any variety), (5) Sitting breeds (other than the above), (6) Non-sitting breeds (other than White Leghorns), (7) G. E. Railway employees, (8) Championship, (9) Members of the N.U.P.S., and (10) Ducks. In the case of fowls, eggs were classified as first grade during the first four weeks which weighed $1\frac{1}{8}$ oz. or more, during the second four weeks $1\frac{1}{2}$ oz. or more, and during the rest of the trial 2 oz. or more. Eggs of less than those weights but not less than $1\frac{1}{8}$ oz. were classed as second grade, and not more than 100 second grade eggs in Sections 1 to 6, 200 in Section 7, 80 in Section 8, and 40 in Section 9 were included in the pen score for competitive purposes. No eggs weighing less than $1\frac{1}{8}$ oz. were scored. As regards ducks, only eggs weighing 2 oz. or more scored.

The following table shows the total number of eggs laid by each breed during the 44 weeks:—

FOWLS.

Died during Test	No. of Birds entered	Breed	Eggs Laid		Total	Average per bird for 14 weeks
			Grades	2nd		
32	610	White Leghorns ...	91,026	8,192	102,218	162.69
12	373	White Wyandottes ...	50,969	8,717	58,786	159.86
3	203	Rhode Island Reds ...	27,934	2,111	30,315	150.43
4	163	Light Sussex ...	12,689	896	13,585	133.64
—	25	Speckled Sussex ...	2,883	115	3,328	133.10
—	5	Barred Rocks ...	627	6	633	126.60
1	9	Buff Rocks ...	979	25	1,004	114.76
—	5	Croad Langshans ...	638	21	659	131.80
—	5	Golden Barred Ply. Rocks ...	662	21	683	138.00
—	10	White Orpingtons ...	1,131	47	1,181	118.10
1	10	Buff Orpingtons ...	1,110	117	1,257	132.79
—	5	Columbian Wyandottes ...	654	74	728	145.60
5	60	Anconas ...	8,392	195	8,587	147.95
—	10	Brown Leghorns ...	1,254	11	1,295	129.50
4	65	Black Leghorns ...	8,694	759	9,414	152.59
1	10	White La Bresse ...	1,320	117	1,467	156.93
—	2	Golden Campines ...	128	—	128	64.00
32	1,540	TOTAL ...	213,193	22,435	235,328	
		Eggs under weight ...	—	—	316	
		Unrecorded eggs ...	—	—	1,602	
					237,276	

DUCKS.

Died during Test	No. of Birds	Breed	Eggs laid		Total	Average per bird for Test
			1st Grade	Under Weight		
1	30	Buff Orpingtons ...	4,842	14	4,858	161.93
—	5	Cosley Fawns ...	1,094	12	1,106	221.20
1	75	Khaki Campbells ...	13,980	56	14,056	188.45
3	80	Indian Runners (Fawn and White)	13,887	25	13,912	173.92
—	70	Indian Runners (White) ..	11,591	19	11,601	165.72
—	5	Marples ...	779	1	779	154.20
5	265	TOTAL ...	43,161	110	43,391	175.91
		Eggs unrecorded ...	—	—	141	
					43,441	

The number of eggs per bird produced by the five leading pens in each of the Sections was as follows:—

1	White Leghorns ...	204, 199, 178, 193, 193.
2	White Wyandottes ...	202, 196, 195, 189, 189.
3	Rhode Island Reds ...	182, 176, 175, 175, 174.
4	Sussex ...	170, 167, 164, 159, 153.
5	Other Sitting Breeds ...	146, 137, 135, —, —.
6	Other Non-sitting Breeds	192, 189, 176, 175, 163.

7	Championship (All White Leghorns, 10 in pen)	190, 188, 187, 178, 175.
8	G.E. Ry. Employees (4 pullets)	186, 178, 178, 162, 156.
9	Members N. U. P. S. (2 pullets)	204, 199, 197, 194, 191.
10	Ducks (5 in pen) :—	
1	Khaki Campbells	233.
2	do.	227."
3	Coaley Fawns	219.
4	Khaki Campbells	217.
5	Fawn and White Runners	209.

It is mentioned in the report of the trial that throughout the test the health record of both pullets and ducks was excellent. The comparative immunity from infectious diseases is attributed to the exclusion of any pens containing unfit birds, even if they were suffering only from contagious catarrh, which, even if not serious in itself, offers a seed bed for roup.

* * * * *

NURSEYRYMEN and others interested in the export of plants, bulbs, etc., to New Zealand should note that, under amended regulations issued by the Dominion Government, all consignments imported into the Dominion from this country must be accompanied by a certificate issued by an Inspector of the Ministry. Certificates issued by the Director of any public or botanic garden in this country will not in future be accepted. Applications for the necessary certificates should be addressed to the Secretary, Ministry of Agriculture, at 10, Whitehall Place, London, S.W.1.

* * * * *

PERSONS concerned in the trade in plants, bulbs, etc., to the United States of America, may be interested in the developments which have taken place since the Conference on the U.S.A. Plant Import Regulations (Quarantine No. 37) was held in May last, when British interests were represented by Mr. W. G. Lobjoit, Controller of Horticulture of the Ministry.

Three small modifications in the regulations have since been made. These extend the period during which Rhododendrons

may be imported under permit, restrict the sizes of rose stocks admitted, and modify the requirement as to removal of soil from the roots of plants so as to allow the use of other means beside washing.

In addition the U.S. Department of Agriculture has now authorised for a period not exceeding three years from 1st January, 1923, the addition to this list of the following varieties of bulbs:—

Chionodoxa (glory-of-the-snow).
 Galanthus (snowdrop).
 Scilla (squill).
 Fritillaria imperialis (crown imperial).
 Fritillaria meleagris (guineahen-flower).
 Muscari (grape hyacinth).
 Ixia.
 Eranthis (winter aconite).

It is also announced that the entry of Narcissus is limited to a period of three years only from 1st January last.

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As was anticipated, the recent Martinmas hirings were the occasion of further reductions in the wages of a number of

farm workers in Scotland.

Farm Wages in Scotland.*

Married Ploughmen.—In the greater part of Scotland married ploughmen are usually engaged for a year from Whitsunday, and consequently were not affected by Martinmas hirings. New bargains are made at Martinmas, however, with married ploughmen in the industrial areas stretching from Dundee to Ayr, and from the following table of the estimated wages at different periods it will be seen that considerable reductions have been made in these areas:—

AREA.	CASH WAGES.			
	1907.	Summer 1921.	Winter 1921-22.	Winter 1922-23.
Lower Clyde Valley and North				
Ayr... ..	17/-	58/-	49/-	37/-
Stirling and West Fife... ..	17/-	57/-	48/-	38/-
East Fife, South Forfar and				
Perth Lowlands	15/-	45/-	34/-	27/-

It should be remembered that the cash wage does not include the value of allowances in kind, which now ranges from 9s.

* From particulars given in a communication received from Sir James Wilson, R.C.S.I.

per week in Stirling and West Fife to 11s. in East Fife and district.

The average cash wage of married ploughmen for the whole of the areas of Scotland for which statistics are available is now 31s. per week, with allowances valued at 7s. 2d., thus making the total earnings 38s. 2d. per week. If account is taken, however, of the large number of ploughmen in the counties in which earnings are higher, and of the reports that the men who stayed on in their old places obtained higher rates than those who changed employment, the present average earnings of this class of worker come to about 40s. per week, or 82 per cent. above the 1914 level.

This compares favourably with the latest cost of living index figure of the Ministry of Labour, and shows that the standard of living of the married ploughman is at least being maintained at the pre-war level.

Single Ploughmen.—In the majority of areas single ploughmen engage for a half-year from Whitsunday, and so have to make new bargains at Martinmas. Average reductions in wages of about 4s. per week were made at Martinmas, in spite of which a considerable number of men remained unengaged.

Women Workers.—In most cases there was a slight fall in the wages offered to women, although there is some difficulty in getting a sufficient supply of this class of worker.

* * * * *

SOME interesting particulars are now available concerning a "Clean Milk" Scheme which was operated in Birmingham

**A Birmingham
Clean Milk
Scheme.**

last year by the Midland Counties Dairy Company. Under this Company's scheme bacterial counts were taken every day from a sample of the milk sent in by each of the supplying farmers. A bonus was then paid at the end of every month to the 36 farmers whose milk during the month was found to contain the lowest number of bacilli per cubic centimetre. Of these 36 farmers, the 12 whose score was the lowest received one penny per gallon extra for all their milk, and the next 24 a half-penny per gallon extra. In this way some of the farmers who competed received from £50 to £60 each more for their milk than they otherwise would have received. The following were the best six and the worst six scores (in bacteria per cubic centimetre) during the months mentioned:—

LOWEST SCORES (*cleanest milk*).

	May (1922)	August	December
1 ...	9,000	3,400	6,650
2 ...	12,000	9,900	7,500
3 ...	14,000	12,000	8,500
4 ...	18,000	12,750	10,900
5 ...	22,200	14,250	12,900
6 ...	32,000	16,000	13,500

(The farms which took the first, second, third, etc., place in May were not necessarily the same farms which took those places in August and December.)

HIGHEST SCORES (*dirtiest milk*).

1 ...	10,744,666	8,070,000	648,800
2 ...	12,000,000	10,488,500	750,000
3 ...	16,042,000	11,640,000	859,500
4 ...	Uncountable*	12,010,000	1,377,000
5 ...	Uncountable*	15,035,500	1,950,000
6	Approx. 30,000,000	19,580,000	Over 50,000,000

* In 1/10,000 dilution.

Some 80 to 90 farmers in all competed under this scheme, and it is understood that the average bacterial count of about half of them was lower than 20,000 per c.c.

The results of this admirable scheme must give satisfaction to all who wish to see a higher standard of cleanliness in the milk supply, and it is to be hoped that the example set by the Midland Counties Dairy Company will be followed by other large milk distributing companies throughout the country.

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THE Ministry desires to call the attention of hop growers to the advisability of taking immediate steps to limit their production of hops during the current year. The

**Temporary
Restriction of
Hop Production.**

consumption of beer in the United Kingdom has been reduced to approximately one-half of its pre-war level. There are now about 27,000 acres under hops as compared with 36,000 acres before the War. In consequence, if an average crop is produced on the existing acreage there will be a considerable surplus of English hops over and above the amount brewers will require should consumption not increase. Further, it is estimated that a surplus of about 100,000 cwt. of the 1922 crop of English hops will be left in growers' hands after the Hop Controller has completed his purchases to meet brewers' requirements for the current season. In these circumstances, the Hop Controller does not expect to be able to purchase from

each grower a greater quantity of the 1923 crop than is approximately equivalent to three-quarters of the amount arrived at by multiplying the average yield per acre obtained by that grower in 1920, 1921, and 1922, and the acreage which that grower cropped with hops in 1922. A formal intimation of the amount of 1923 hops which the Hop Controller is prepared to purchase from him will be sent to each grower, but as the issue of these notices may take some time the Ministry considers it advisable to warn growers in order that they may at once begin to take steps to restrict the production from their acreage to this lower amount in order that they may have no surplus left on their hands when the Hop Controller has taken the amount of which he can dispose.

It is a penal offence for any person to buy or sell or agree or offer to buy or sell any hops without a permit issued under the authority of the Hop Controller who is authorised to act on behalf of the Minister in this matter, and the Hop Controller will not be prepared to buy, or issue permits for the sale for consumption in Great Britain or Ireland of hops produced in excess of the quantity specified to each grower in the formal notice referred to.

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REPLIES TO CORRESPONDENTS.

"Hubam" Clover.—W.S. asks whether "Hubam" clover and sweet clover refer to the same plant. He understands that sweet clover has great possibilities as a forage crop, and that it is valuable to bee keepers as a honey yielding plant if allowed to grow to the flowering stage.

Reply: Sweet clover is a general term referring to no fewer than 4 distinct varieties of *Melilotus*. There is a yellow biennial variety, a yellow annual variety, a white biennial variety and a white annual variety. "Hubam" clover is the white annual variety, developed by Professor H. D. Hughes of the Iowa Experiment Station, from selected seed obtained from Alabama.

In America, the biennial variety is seeded in spring on autumn sown rye or wheat, or with barley or oats, at the rate of 12 to 15 lb. of scarified seed per acre. The crop is harvested the following year just before the blossom buds appear.

The annual variety, "Hubam," is sown in early spring and is cut for forage the same year. The seeding is made on bean-land, potato-land or on fallowed land in clean, firm condition. In America, seeding in early spring gives a forage crop in mid July.

Black Spot on Roses.—Miss . . . would be glad of information with regard to Black Spot on rose bushes.

Reply: This disease is caused by a fungus, *Actinonema rosae*. In some varieties of rose this fungus winters on the young twigs which, when infected, should be cut out.

Dusting with 1 part powdered arsenate of lead and 9 parts finely ground sulphur in May and at fortnightly intervals afterward, has been found very effective, but of course this is a very poisonous preparation and not advisable in a garden if children or animals may have access. Spraying with lime-sulphur at half the strength of that used for Apple Mildew (see details in Leaflet No. 204) has been also found useful, though this renders the bush unsightly.

Diseased Strawberries.—A.Z. sends a strawberry plant "smothered by queer growth."

Reply: The strawberry plant has suffered from the smothering effects of one of the Myxomycetes, *Spumaria alba*. This is a very lowly form of fungus,—indeed it is doubtful if it should be so classified. It increases in size and climbs slowly over plants, especially up the stems of living grasses, and forms, first, white masses, followed later by the soot-like masses of dark spores.

It is not a parasite, but may act harmfully in smothering the plant. It is more common in England on grasses, but has been noted in France on strawberries. The spores may have been introduced in one of many ways, but probably with the manure. It is not very common, and if the bed is well dug and the affected plants thoroughly cleared away and burnt it will probably not occur again.

White Clover.—Q.R. requests the necessary information for detecting Wild White Clover from the ordinary White Dutch Clover.

Reply: It is difficult to distinguish the two. If White Clover appears in response to basic slag, it may of course be supposed to be wild white. Otherwise the two varieties cannot be distinguished botanically, though the wild variety differs somewhat in habit from the cultivated. These differences are set forth in a pamphlet on the "Romance of Wild White Clover" obtainable from Messrs. Gartons of Warrington. Leaflet No. 355 states that the seed of wild white is on the average slightly smaller and that the wild variety is more persistent.

Getting Rid of Tree Stumps.—S.T. asks whether stumps can be burnt by boring with an auger and putting chemicals in.

Reply: Referred to Ministry's Report on Stump Clearing Devices and informed that processes of chemical disintegration were shown by the Ministry's investigations to be futile.

Starch Equivalent of Feeding Stuffs.—U.V. asks for an explanation of the term "starch equivalent."

Reply: By the "Starch equivalent" of a feeding stuff is meant the number of pounds of starch which is equivalent, for the production of energy, to 100 pounds of that feeding stuff.

In the Ministry's Miscellaneous Publication No. 32 this is worked out in two ways as "gross digestible energy" and as "net digestible energy," the latter being usually taken as giving the best figures for the productive value of feeding stuffs.

The "net digestible energy" of wheat, for instance, is 71·6; in other words, if you feed 100 lb. of wheat it is equivalent, for productive purposes, to feeding 71·6 of starch.

Take wheat for instance at £9 15s. per ton. For every ton of wheat fed 18s. comes back in the form of manure. Therefore in feeding a ton of wheat, the feeding costs £8 17s. That is, you pay £8 17s. for a ton of wheat, which for practical purposes may be regarded as containing 71·6 per cent. of starch. What therefore do you pay for 1 per cent. of starch? This you ascertain by dividing the price £8 17s. by 71·6—which gives approximately 2s. 6d. The use of figures thus obtained is a convenient way of comparing the value of feeding stuffs.

Pig Farming.—W.X. asks for figures of capital required. :

Reply : It is practically impossible to give even an approximate estimate which would cover all holdings of various sizes and with varying accommodation. The following figures and notes might assist in preparing a rough estimate :—

Capital.

Land (if purchased) say £25 per acre.

Buildings. Good shelters for running on outdoor system at rate of £5 per sow.

Stock. £10 per acre (1 Breeding Sow per acre).

Fencing and Feeding Utensils, £1 to £2 per acre.

Expenditure.

Rent and Rates. 30/- per acre.

Labour. 1 man to every 150 pigs.

Foods. Average cost per head per week, 2/6.

Income.

Each sow should produce 10 pigs per year which at 4·5 months would average 100 lb. dead weight, worth approximately 1/- per lb.

General.

It should be possible to purchase and start a small-holding of 10 acres with £500 and expect a return of 23·30 per cent.—no charge being made for labour.

Crab-apple Trees.—T.R. asks whether the presence of old crab-apple trees in the hedge of an orchard is detrimental to young apple trees, through pollination or in any other way.

Reply : Crab-apple trees growing wild usually produce abundant pollen which should facilitate fertilisation of blossoms of cultivated trees in the vicinity. If the wild trees harbour insect or fungus pests, then they become a source of infection and should be destroyed.

Parsnip Canker.—A Chichester correspondent writes : I shall be glad if you will let me have a copy of any leaflet published on Parsnip Canker, or give me what information is available on this disease.

Reply : In reply to your enquiry of the 16th inst., the Ministry has not published a leaflet dealing with Parsnip Canker, but the trouble is described in some detail by Mr. A. D. Cotton in the Kew Bulletin, 1918, p. 8, and is shown to be "due primarily to a physiological phenomenon which causes the surface tissues to become ruptured, and not to the invasion of a fungus parasite. Cracking takes place during the growing season, especially if rains follow a dry period, and the cracks gape open exposing the soft inner tissues. The canker or decay which follows is the result of the inability of the parsnip to form a layer of wound cork. Though canker is worse in some localities than others it appears to occur in all districts if rupturing of the skin takes place.

Over-manuring, neglect of liming, early sowing (inducing premature ripening) may favour the formation of cracks. The variety of parsnip grown may also be partly responsible, a form of high quality, with bulky top, abundant flesh, and small core being very largely cultivated in the worst areas.

With regard to preventive measures the grower is advised to avoid too rich a soil and to adopt late sowing. Liming must not be neglected and a proper rotation should be given—parsnips must never be grown for two years in succession on the same land. The writer also mentions a dressing of salt as having been found effective in some cases—on heavy soils 5 cwt. per acre, on light soils up to 10 cwt. per acre. The use of potash manures is also suggested.

White Fly in Greenhouses.—R.L. asks have you a leaflet or can you advise me the best way of getting rid of White Fly in greenhouses?

Reply: With reference to your letter of the 30th January, the only method of dealing with White Fly upon tomatoes is by means of fumigation, but to obtain the best results it is necessary to use a powerful fumigant such as hydrocyanic acid gas. A leaflet dealing with this treatment is enclosed.

If the highly poisonous nature of hydrocyanic acid gas should be a disadvantage under the circumstances in which you have to use it, you might try tetrachlorethane, and a memorandum on this fumigant is therefore also enclosed. If you have a difficulty in obtaining tetrachlorethane, you will see advertisements in most fruit-growing or gardening papers for proprietary fumigants for use against White Fly on tomatoes which have much the same effect.

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Leaflets issued by the Ministry.—Since the date of the list given on page 671 of the October issue of the *Journal*, the following leaflets have been revised.

Revised.

- No. 32.—Foul Brood.
- " 111.—Co-operative selling of Eggs.
- " 162.—The Cultivation of Mangolds.
- " 197.—Agricultural Education in England and Wales.
- " 333.—Fish Meal as a Food for Live Stock.
- " 358.—Fruit and Vegetable Drying.
- " A 316(1).—Abridged List of Publications

The following new leaflets have been issued.

- No. 395.—Diseases of Adult Bees.
- " 396.—Feeding Home-grown Cucu and Potatoes to Live Stock.

The following leaflets are no longer issued free:—

- No. 374.—Hints on Egg Production.
- No. 375.—" " The Production of Table Poultry.
- No. 376.—" " Rabbit Keeping.

Foot-and-Mouth Disease.—A further outbreak of foot and-mouth disease occurred at Handley, Cheshire, on 30th January, which involved the slaughter of two cows, the only animals on the premises. As a result of this outbreak restrictions were again applied to an area around Handley, but the circumstances of the outbreak permitted an early reduction of the prohibited area in view of the fact that it had recently been subject to restrictions, and no movements had taken place involving a risk of the spread of the disease.

All restrictions in the Glamorgan district were removed as from 8th February. The outbreak in this county having been successfully confined to the originally infected premises.

On 10th February disease was confirmed on premises at Northcach, Glos., 3 heifers of a lot of 4 being found affected. There had been recent movements to local markets, but there has been no extension of disease except to premises in the proximity of the original outbreak—on which the existence of disease was confirmed on 12th inst. The usual restrictions were imposed on 10th February.

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NOTICES OF BOOKS.

The Evolution of Climate.—(C. E. P. Brookes, M.Sc. (173 pp.) London: Benn Bros., Ltd., 1922. 8/6 net.) It is remarked in the introduction to this book that meteorologists are still so much occupied with the present vagaries of the weather that few of them have the time to extend their researches into the geological past, though therein may be the key to the solution of many problems which they have hitherto faced in vain. Mr. Brooks has applied his knowledge of geology and meteorology to reconstruct the sequence of climatic change through which the world has passed during that important stage of geological history commonly known as the ice age or glacial period. The historical record is preceded by a chapter dealing generally with factors of climate and the causes of climatic fluctuations, and the book concludes with a brief review of the influence of these fluctuations on the evolution of man and the history of civilization.

Pests.—(Palmer and Westell (412 pp.) London: Henry J. Drane, 1922. 25s.) In this book the authors have attempted to give a concise but comprehensive summary of all the important pests, both animal and vegetable, affecting the products of the farmer, forester, fruit-grower and gardener—a "pest" for the purpose of the book being defined as any animal, plant or vegetable organism which is injurious to any kind of crop, produce, or cultivated plant, whether directly or indirectly, and any insect attacking domesticated animals or annoying man himself. The authors have wisely recognised that the practical man has seldom the time or inclination to read intricate scientific details of the natural history of the pests which trouble him, and they have, therefore, concentrated attention on the necessary information at present available to enable him to identify and as far as possible to control or prevent their ravages. A work of this nature necessarily consists largely of compilation, but the references to authorities to whom the authors acknowledge their indebtedness show that the standard works on the various subjects have been drawn upon, and the book presents, in a convenient form, up-to-date information for which otherwise a number of technical and expensive publications would have to be consulted.

The volume, which is of "royal octavo" (10 in. by 6½ in.) size and is handsomely bound in green cloth, is copiously indexed and illustrated, and contains a useful glossary of scientific terms used, besides identification and spraying tables and a monthly calendar of anti-pest operations.

English Local Government—Statutory Authorities for Special Purposes.—(Sidney and Beatrice Webb. (521 pp.) London:

Longmans, Green & Co., 1922. 25s. net). This book constitutes the fourth and final volume of Mr. and Mrs. Sidney Webb's survey of the constitutional structure of English local government from the Revolution (1689) to the passing of the Municipal Corporation Act (1835). Like the preceding studies of "The Parish and the County" and "The Manor and the Borough," it represents a monumental amount of research in recondite contemporary sources, tracing the origin, development and function of such hitherto unexplored organisations as the Court of Sewers, Incorporated Guardians of the Poor, Turnpike Trustees and Improvement Commissioners—who, it is pointed out, were the forerunners of most of the municipal administration of the 19th century. The last two chapters, summarising the contents of the complete survey, give an illuminating account of the gradual transformation of the old institutions and their adaptation to the new conditions and conceptions arising from the industrial revolution and the social and economic changes proceeding from it. As was to be expected from the learned historians of trade unionism and industrial democracy the books are an important addition to historical literature, and should be of special interest to all who are engaged in municipal and local administration.

Electricity in Agriculture.—(Arthur H. Allen. (111 pp.). London: Pitman & Sons, 1922. 2s. 6d.). The applications of electricity to agriculture in this country are still largely unexplored and there is obviously room for a book of even such modest scope as this primer—the first of its kind to be published in this country—indicating briefly some of the chief uses of electricity in the various mechanical operations of the farm, the sources of power available and the methods by which it may be distributed. A chapter is devoted to the domestic applications of electricity in indoor lighting, cooking, heating, etc., and another to "electro-culture"—the latest experiments in which were summarized in the December number of this *Journal*.

Practical Fruit Farming.—(R. G. Hatton, M.A., and Walter B. Edgar, F.S.I. (87 pp.). London: John Murray, 1922. 2s.). "The more one looks into the history of fruit culture the more one is forced to the unpleasing conclusion that, at any rate during the last century, but slow progress has been made in the acquisition of scientific knowledge and in the application thereof: we are now, as it were, only scratching on the surface of a rich and partly unexplored field." This is the conclusion arrived at by Mr. Edgar, whose contribution on "The Planting, Cultivation, and General Management of Orchards in Kent" forms the second part of this useful pamphlet on Practical Fruit Farming, issued by the Royal Agricultural Society. In the first part, by Mr. Hatton, whose work as Director of the East Malling Research Station is well known to pomologists, an attempt is made to indicate how far the conclusions of the research worker are of immediate application to the practical grower, and how far the observations and consequent methods of the most successful practical growers have borne the test of time. Considerations are discussed for the selection of a holding, preparation and planting, pruning, manuring and treatment of diseases and pests, and an extensive list of references is added to more exhaustive works on different sections of the subject.

Wheat Costings.—(Herbert Grange. (16 pp.). London: P. S. King & Son, 1922. 1s. 6d.) In this 16-page pamphlet, issued with the object of

drawing attention to the present and prospective position of the grower of corn, Mr. Grange gives an analysis of costs of wheat production per acre and per quarter for the years 1914 and 1919-1922 under the six separate headings of rent, rates and insurance; seed; manure; horse labour; manual labour; and repairs and sundries. The figures for the last two years show an approximate net loss of £6 and £4 10s. per acre, respectively. Mr. Grange explains the basis on which his calculations are based and, though his figures will require modification in the light of fluctuating prices and individual experience, the pamphlet may be of assistance to other inquirers interested in the economics of wheat production.

The Maintenance of the Agricultural Labour Supply in England and Wales during the War.—(J. K. Montgomery. (121 pp.) Rome: International Agricultural Institute. 2s. 6d.) In this report Mr. Montgomery, Chief of the Bureau of Economic and Social Intelligence of the International Agricultural Institute, gives a classified summary of the chief measures taken in this country to supply the place of agricultural workers withdrawn from the land for military service during the War and to provide supplementary labour for the increased production which was required to assure the food supply of the country. Most of those measures were noted in this *Journal* from time to time as they arose during the progress of the War, but future reference will be much facilitated by Mr. Montgomery's memorandum, in which he brings together the various arrangements made for the supply of labour by soldiers, prisoners of war and interned civilians, women landworkers, refugees, conscientious objectors and volunteer helpers. The final chapter gives an account of the working of the Agricultural Wages Board, including tables of minimum wages fixed for workers of various ages in different districts down to the abolition of the Board in August, 1921.

The Journal of Pomology and Horticultural Science.—The growing of their crops tests the full capacity of those engaged in the industry of horticulture, and the measure of success attained by each grower serves as a guide to his ability as a cultivator. Some produce the finest crops—others, smaller crops of a lower quality, but all have difficulties of divers kinds to contend with.

The soil has its own special problems, which even at the present time are only partially understood, though our scientific research workers are gaining more knowledge every year. The plant, be it for fruit, flower, or vegetable production, is always giving anxiety to the cultivator. Is it the right kind for his purpose? Has he the best variety in existence? Are his fruit trees grafted on the right stock to suit his purpose? These are questions put to every good commercial grower. Diseases of crops, also, are always troublesome.

If left unprotected, horticultural crops are attacked by diseases and pests, and growers are not always clear as to the best means to adopt to keep plants healthy. All these problems can only be properly dealt with by those having full knowledge of the pest, and this can be acquired by keeping in constant and close touch with the results of work carried out at research stations. There are at least five such stations in this country engaged on horticultural work: the Long Ashton Horticultural Research Station (near Bristol), the

East Malling Horticultural Station, the John Innes Institute (Merton, Surrey), and the Lea Valley Horticultural Experimental Station (Herts.). At these stations scientific workers are investigating problems of many kinds, differing in character from the manuring of the tomato plant to the control of silver leaf disease. All the work is of importance to the commercial grower.

The reports of this research work will be published in the Journal of Pomology and Horticultural Science, which in effect is the official organ of the first three aforesaid research stations. The Journal will be published quarterly, and can be obtained either from the research stations or from the publishers. The annual subscription is 15s., post free.

The first issue of the new series was published in November, 1922, and contains articles on:—

Commercial Raspberries and their Classification (*N. H. Grubb*);

Apple and Plum Case Bearer (*E. V. Theobald*);

Control of the Apple Blossom Weevil (*H. W. Miles*);

together with several shorter notes.

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ADDITIONS TO THE LIBRARY.

Agriculture, General and Miscellaneous.

Allen, J. H.—Electricity in Agriculture. (111 pp.) London: Pitman & Sons, 1922, 2s. 6d. [567.]

Brooks, C. E. P.—The Evolution of Climate. (173 pp.) London: Bent Bros., 1922, 8s. 6d. [561.5.]

Haas, P., and Hill, T. G.—An Introduction to the Chemistry of Plant Products, Vol. 2:—Metabolic Processes. (110 pp.) London: Longmans, Green & Co., 1922, 7s. 6d. [58.11; 54(02).]

Weaver, J. E., Jean, F. C., and Christ, J. W.—Development and Activities of Roots of Crop Plants: A Study in Crop Ecology. (117 pp. and 14 Plates.) [Carnegie Institution of Washington Publication 316.] Washington, 1922, \$2. [58.33.]

U.S. Nitrate Division, Ordnance Office War Department and the Fixed Nitrogen Research Laboratory Department of Agriculture.—Report on the Fixation and Utilization of Nitrogen. (853 pp.) Washington, 1922. [663.6; 63.1671.]

Howell, J. Pryse.—The Productivity of Hill Farming. Being the Report of an Inquiry in three Typical Districts. (23 pp. + 7 statistical tables.) Oxford: University Press, 1922, 1s. [63.12; 63.6-42.]

Denmark: Statsfokontrollen. — Statsfokontrollen, 1871—1876—1921. (160 pp.) Copenhagen, 1922. [63.1951.]

U.S. Department of Agriculture.—Farmers' Ball. 1271.—Farm Lands available for Settlement. (51 pp.) Washington, 1922. [325; 63.73.]

The Association of British Chemical Manufacturers.—Official Directory of Members with Classified List of their Manufactures. 399 pp. London: Offices of the Association, 1923, 10s. 6d.

Field Crops.

University College of Wales, Aberystwyth.—Bull. No. 4:—Investigation on the Composition of Farm Crops. First Report. (11 pp.) Aberystwyth, 1922. [63.3041.]

Horticulture and Fruitgrowing.

Bennett, P., and Kohde, R. S.—A Vegetable Grower's Handbook. (174 pp.) London: P. Lee Warner (Chiswick Press), 1922, 6s. [63.511(02).]

U.S. Department of Agriculture.—Farmers' Ball. 1269.—Celery Growing. (32 pp.) Washington, 1922. [63.511.]

U.S. Department of Agriculture.—Bull. 1082.—The Production of Tulip Bulbs. (48 pp.) Washington, 1922. [63.52.]

Royal Agricultural Society of England.—Practical Fruit Farming, by R. G. Hutton and W. R. Clagar. (87 pp.) London: John Murray, 1922, 2s. [63.41(04); 63.41(42).]

U.S. Department of Agriculture.—Farmers' Bull. 1284 :—Apple Orchard Renovation. (32 pp.) Washington, 1922. [63.42(04).]

Seabrook, W. P.—Fruit-Packing for Market : a Practical Treatise on the Grading, Packing and Marketing of Hardy Fruit. (90 pp.) London : George Allen & Unwin, Ltd., 1923, 2s. 6d. net. [63.41—198.]

California Agricultural Experiment Station.—Bull. 344 :—Cold Storage as an Aid to the Marketing of Plums : a Progress Report. (pp. 428—463). Berkeley, 1922. [63.41—198.]

Plant Pests and Diseases.

Palmer, R., and Westell, W. P.—Pests of the Garden and Orchard, Farm and Forest : A Practical Guide for the use of the Estate Owner, Farmer, Fruit Grower and Gardener concerning the Insects, Birds and Other Animals, Fungoid Diseases and Weeds, affecting Agriculture, Horticulture and Forestry ; together with Remedial Measures. (412 pp.) London : H. J. Drane, 1922, 25s. [63.24(02) ; 63.27(02) ; 63.259(02) ; 63.26 ; 63.295 ; 59.162 ; 63.206.]

Canada Department of Agriculture.—New Series Bull. 7 (Ent. Bull. 21) :—Insects Affecting Greenhouse Plants. (63 pp.) Ottawa, 1922. [63.27—41 ; 63.27—51 ; 63.27—52.]

U.S. Department of Agriculture.—Bull. 1104 :—Internal Browning of Yellow Newtown Apples. (24 pp.) Washington, 1922. [63.21.]

Connecticut Agricultural Experiment Station.—Bull. 235 :—Experiments in Dusting v. Spraying Apples and Peaches in Connecticut in 1921. (pp. 209—226.) New Haven, 1922. [63.294.]

Live Stock and Feeding Stuffs.

Gouin, R.—Les Aliments du Bétail et les Intoxications Alimentaires. (366 pp.) [Encyclopédie Agricole.] Paris : J. B. Baillière et Fils, 1922, 15fr. [63.255 ; 63.6042(02).]

Gouin, R.—Alimentation Rationnelle des Animaux Domestiques. (403 pp.) Fifth Edition. [Encyclopédie Agricole.] Paris : J. B. Baillière et Fils, 1922, 15 fr. [63.6043(02).]

Olympia Agricultural Co., Ltd., Research Department.—Bull. 3 :—Feeding Experiments with Fattening Pigs. (33 pp.) Offchurch, Leamington, 1922. [63.64 : 043.]

U.S. Department of Agriculture.—Farmers' Bull. 1263 :—Breeds of Swine. (22 pp.) Washington, 1922. [63.64(04).]

U.S. Department of Agriculture.—The Live Stock Industry in South America. (35 pp.) Washington, 1922. [63.6(8).]

Massachusetts Agricultural Experiment Station.—Bull. 205 :—Dried Apple Pomace for Farm Stock. (pp. 135—148.) Amherst, 1921. [63.604(a).]

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